The

Electrical Review

VOL. CVI. APRIL 25, 1930. No. 2785.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman and Joint Managing Director: G. H. ALABASTER, COMPANION I.E.E.

Technical Editor: C. O. BRETTELLE, M.I.E.E.

Joint Managing Director: E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E.

Commercial Editor: A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 6871 (6 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
The Writing of English	761
Standardising Authorities	762
Local Branches of the E.A.W.	762
Possibilities in Argentina	762
Lighting Voltages	762
Power Station Extensions *(illus.)*	763
The Training of Electricians, by J. A. Kendrick	766
The New Madame Tussaud's, by J. H. Maudsley *(illus.)*	767
Vehicle Lighting Problems	769
The English Essay for the I.E.E. Examination	770
Electricity for the Home *(illus.)*	772
Electric Ship Propulsion *(illus.)*	773
Rolling Mill Electrical Equipment *(illus.)*	777
Business and Industrial Notes	778
Lighting and Power Notes	781
Tramway and Railway Notes	783
Telegraph and Telephone Notes	783
Radio Notes	784
Contract Information	784
Forthcoming Events	785
Notes	785
Our Personal Column	787
Financial Section—	
New Companies Registered	788
Official Returns of Electrical Companies	788
City Notes	789
Financial Section—*contd.*	
Stocks and Shares	791
Our Foreign Electrical Trade	793
The Argentine Electrical Market	794
Indian Electrical Notes	794
Hospital Operating-table Lighting *(illus.)*	795
The Central Electricity Board *(illus.)*	796
Swiss Railway Electrification *(illus.)*	797
Distribution Voltage Standardisation	798
Electrification in Jugo-Slavia	798
Low Power-factor Measurements, by E. H. Rayner, W. G. Standring, R. Davis, and G. W. Bowdler	799
X-Ray Kinematography, by A. Salmony *(illus.)*	799
Modern Tramcar Control *(illus.)*	800
Hydro-electric Development in Canada	801
Reviews	802
Legal	804
Parliamentary News	805
Correspondence—	
The B.E.A.M.A. and the Universities	806
Synchronised Time	806
Measurement of High Temperatures	806
Electricity Supply Transformer Systems	806
Mr. H. Quigley's Articles	807
Published Specifications	807
Trade Mark Applications	807
New Work for Contractors	808

The Writing of English.

ABOUT one month hence the "I.E.E. exam." will be held, when many young engineers will take the opportunity of doing a duty to themselves and to their profession by seeking corporate membership of the Institution.

The part of the ordeal that causes most uneasiness is, in many cases, the English paper, and the hints given in an article appearing in this issue will, no doubt, be of benefit to some of the candidates. The writing of clear and concise English is equated by that experienced authority the City and Guilds of London Institute with such obvious engineering work as the making of sketch plans and the reading of drawings; this point, by the way, is dealt with this week in another article on the training of electricians. We think there can be no doubt that the ability to draw up a report that shall be brief, definite, and readily understood is a qualification which should be required of every engineer.

There is, however, some truth in the prevalent view that engineers in general are averse from expressing themselves on paper. How far this attitude may be due to a particular "inferiority complex" which often accompanies an engineering outlook, or how far it may be due to a lack of appreciation of the proper function of writing, is open to question.

We incline to the latter view. Training makes a heavier call on time and thought in the engineering profession than it does in most other occupations, and few opportunities are provided of becoming acquainted with the better examples of writing. Thus the young engineer comes to make a false distinction between a plain unvarnished statement and "literature," which he may even regard—from a knowledge of unfortunate examples—as made up of verbosity, pretentiousness, and—most horrible of all—flowers of speech, which naturally make no appeal to a sensible man. Good writing is, of course, far more nearly akin to the plain unvarnished statement. Many engineers are like Molière's character who talked prose all his life without knowing it; for "talked" substitute "wrote." The three essential qualities of good prose laid down by a great author are "first of all, clarity; secondly, clarity; and, finally, clarity"; this

is a sound maxim, even if not quite exhaustive. To attain clarity a thorough knowledge of what one wishes to say is needed, together with a method of saying it as briefly as may be consistent with an expression of the exact meaning. Apart from this the writer has no cause to be troubled about style; in fact, as has been said, style is the real man himself. A good prose style implies the existence of intellectual honesty, natural to the scientific mind, that will prevent the use of words to which a precise and helpful meaning cannot be attached. Embellishments, often a disfigurement, are usually as out of place as they would be on a working drawing.

Difficulty in composition is sometimes held to prove that a gift of expression is lacking; this is by no means necessarily so, since it may be due to the fact that what has to be written requires hard thinking, in which case verbal facility may prove a trap. A sentence easy to read is often laboriously composed, especially if its meaning be concentrated in a few words; it may be a hard task to say in one page that which can be said in two without effort.

The fear of committing literary solecisms should not cause diffidence; their avoidance is certainly desirable, but the ability to do so is of infinitely less importance than the qualities needed for clear and concise expression. Many eminent engineers split infinitives as often as these occur, and yet contrive to write about their work in a manner that is as readable as the matter is valuable.

To regard the writing of English as an examination subject, or as a means of reporting to senior officers, is to limit its field to the least important aspects. Rapid progress in engineering depends largely on the use of ideas as soon as they have been conceived. The student of to-day will be the experienced engineer of to-morrow, and unless he has acquired the habit of making a permanent record of his ideas on paper for the benefit of his fellow-engineers, the industry and therefore the individual, will be the loser, on that account, in the future as it has been in the past.

Standardising Authorities.

Readers of these columns will be aware of the importance we have always attached to standardisation of tests and specifications, and the desire of the British Chemical Manufacturers' Association to secure uniformity in this respect is one that has our entire sympathy.

We think, however, that the multiplication of standardising authorities is undesirable, if the desired ends can be achieved by taking advantage of an established body. There is a close affinity between the chemical industry and engineering, and we should like to suggest that the B.C.M.A. should thoroughly consider the possibility of taking advantage of the organisation of the B.E.S.A. before deciding upon the formation of a separate authority. The constitution of B.E.S.A. is such that work of this kind can be adequately covered by the formation of special committees without entailing loss of identity by the participating bodies.

Local Branches of the E.A.W.

At the official luncheon given on the occasion of the official inauguration of the extension to the power station of Kingston-upon-Thames Corporation, Sir John Brooke, C.B., vice-chairman of the Electricity Commissioners, urged the formation of a branch of the Electrical Association for Women in the district as a means of educating the housewife to the advantages of electricity and thereby increasing the domestic load.

We should like to support Sir John's recommendation, and, further, to advocate the extension of its scope to every town served by an electricity undertaking. While the initiative must, naturally, come from the local housewives, since the object of the E.A.W. is primarily to help women to derive benefits from the use of electricity in the home, the chief engineers of supply undertakings can undoubtedly do a great deal to help towards the formation of a nucleus of "electrical women." There need be no question of altruism in the matter, for, although engineers as good citizens will wish for efficient operation of the homes of the people, the effect on load-building is bound to justify any efforts made by the electricity department on the most narrow commercial grounds.

Possibilities in Argentina.

The Argentine market has been dealt with *ad nauseam* during the past few years and most of the reports have not been of too cheerful a nature. We have maintained all along, however, that there *is* business in the Republic for British electrical manufacturers and are therefore heartened somewhat by the latest report issued by the Department of Overseas Trade, which is reviewed in this issue.

True, Mr. Joint says that the British share of the electrical trade, apart from the requirements of the railways, is relatively small, but there are several indications that the position is not hopeless. Like so many other buyers of electrical (and other) goods, the Argentines put price first, but there is reason to believe that they can be educated up to buy better-class goods, in which case the position of British manufacturers will be considerably improved. Even then, however, there remains the question of standards. But if British producers find that it will pay them to conform to the local technical standards (which are American in character) they will no doubt do so, while maintaining the quality of their goods.

Mr. Joint's remarks upon the situation brought about by the American acquisition of electrical undertakings are of interest. He says that the policy of the new owners is to buy in the best market irrespective of national ties. Even if they place their orders for plant in the United States, however, their progressive policy will lead to an increased demand for all kinds of electrical appliances in which British firms will share if they go about the business in the right way.

Lighting Voltages.

To the majority of consumers of electricity, voltage standardisation is a matter of more interest than frequency standardisation. The convenience of being able to use domestic electrical appliances in any area without regard to voltage is obvious, while the reduction in manufacturing costs due to concentration on a smaller range of goods, as well as the saving in investment in stocks for the smaller range, should be reflected in the cost of apparatus.

At one time these advantages were balanced by difficulties in the construction of lamps for one voltage only, and a margin of a few volts on either side was desirable for grading purposes. These conditions have not, however, obtained for many years, and all parties are now agreed upon the desirability of a single standard, which was fixed by the B.E.S.A. in 1925 at 230 V.

Up to the present the number of lamps actually supplied for 230 volts is small, being only about 22 per cent. of the 1,680,000 kW of lighting connections, as deduced from a statement issued by the Council of the Institution of Electrical Engineers and summarised in this issue. From 220 to 240 volts the proportion is 54 per cent. (32 per cent. non-standard), and, in the opinion of the Council of the I.E.E., the non-standard voltages within this range could be brought into line at very little cost; the Council suggests that the Electricity Commissioners should ease the task of the undertakings concerned by relaxing the voltage regulation limits during periods of change-over.

To raise the voltage of undertakings now supplying 37.5 per cent. of lighting connections at voltages from 200 to 215 volts would involve considerable expenditure. As an offset there would be a better distribution efficiency and lower lamp prices. The same consideration as to distribution efficiency would, however, apply in the opposite sense in the case of voltages exceeding 240, but as the total lamp wattage of such undertakings is only some 4 per cent. (approximately equal to that for voltages below 200) they would not greatly affect the situation.

Power Station Extensions.

Brief particulars of the new plant at the Derby Corporation generating station, and the Lots Road, Chelsea, power house of the London Underground Railways.

The Derby Extensions.

THE latest extensions at the Derby electricity works represent the completion of the first boiler house, fired entirely by pulverised fuel, and the replacing of two old-type turbo-generators by

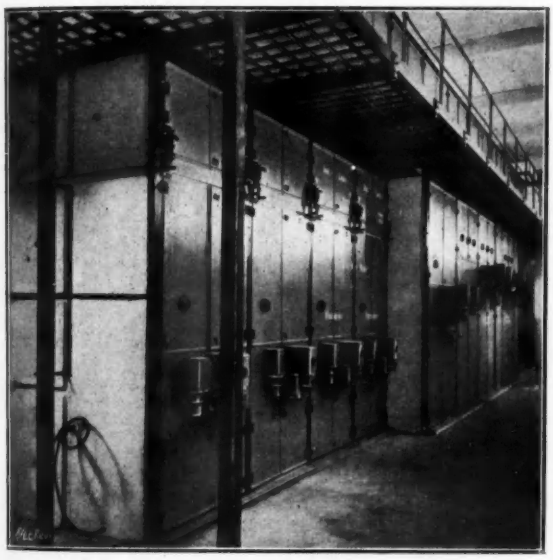


Fig. 1.—New e.h.p. Switchgear in Derby Station.

a machine of greatly increased capacity and of more efficient operation. The two steam generators just completed are different, it is claimed, from any plant installed in this country, and are designed to secure the utmost advantage from the conditions created by the combustion of pulverised fuel. They will each produce from 60,000 to 80,000 lb. of steam per hour at 325 lb. per sq. in. and 750 deg. F. The pulverising equipment has been increased by the installation of a third mill of the "Raymond" 6-roller type, similar to the earlier pulverisers and having the same capacity, namely, six tons of coal per hour. Coal is supplied to the new mill from the adjacent dryer through a chute incorporating a magnetic separator, and a by-pass chute provides an emergency supply direct from the raw-coal bunker.

A new design of feeder is installed for the new boilers, having a capacity considerably greater than the older form, only two being required per boiler, compared with six of the screw-type feeders. The "Duplex" feeder is secured to the bottom of the pulverised-fuel bunker, and consists of two parallel flat plates separated by a casing to form an enclosed box. Both plates are provided with two holes, those in the lower disk being at right angles to the openings in the upper plate. Coal enters the box through the upper openings, and is carried round by a revolving scraper until it passes out through the holes in the bottom plate, which communicate with the throats of two "Venturi" tubes connected to the primary-air fan.

Each boiler is equipped with one "Volcano"-pattern burner built up from the floor of the ash pit and projecting into the combustion chamber through the water screen, the tubes of the latter being set to suit. The "Volcano" burner is an adaptation of the type "R" burner, and embodies many features of the latter. As in the type "R" burner, the fuel enters a "volute" communicating with a hollow conical tube having a series of helical ridges cast on the interior to accentuate the whirling motion imparted to the coal-laden air by the volute chamber. On leaving the cone the current is confined within a vertical tube until the water screen is passed. Near the outlet from the central tube a restriction is formed by a cast-iron bush, rifle-bored, which restores the helical motion lost by friction, and its position is such that the expansion of the coal and air current following the restriction ensures a thorough spreading of the fuel over the edges of the burner. To create further turbulence in the centre of the fuel jet a cast-iron ring with helical vanes is fitted to the burner outlet. Secondary air is admitted to the base of the burner outside the central tube, and is directed towards the mouth of the burner by a brick-work cone cut off just below the water screen. The top of the central tube is belled out and cut away, fig. 3, and the helical motion of the coal and air stream, aided by the expansion following the constriction below the outlet, causes the fuel to spread out, due to centrifugal action, immediately it reaches the burner mouth. The upward flow of secondary air through the spreading coal layer ensures an intimate mixture of fuel and air and creates the conditions necessary for instantaneous combustion. The pulverised-fuel plant was supplied by International Combustion, Ltd.

The steam generators consist of four walls constructed

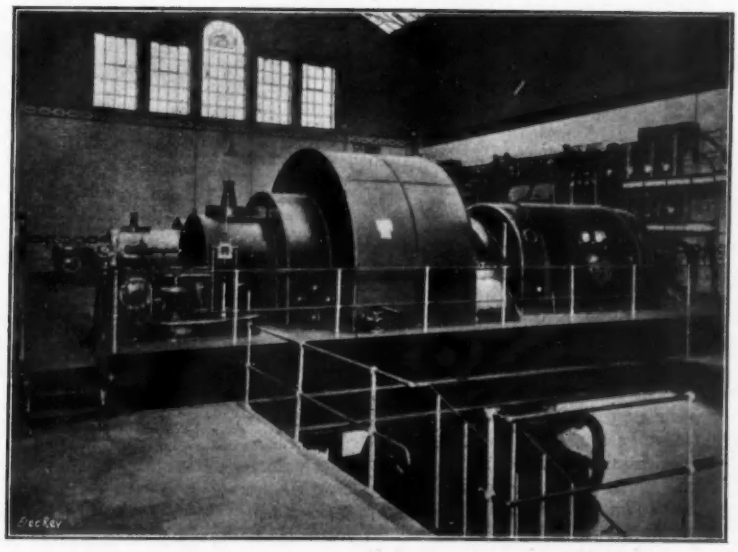


Fig. 2.—New 20,000-kW Turbo-alternator Set at Derby.

of "Murray-fin" tubes completely surrounding the combustion chamber, a water screen at the bottom of the furnace, and a roof comprising four rows of plain

tubes, above which the superheater is suspended. There is no brickwork whatever in the construction of the furnace. A steam and water drum connected to the rear wall tubes is placed across the top of the boiler. The construction ensures positive and vigorous circulation, as all areas are generously proportioned, and the whole of the heating surface is disposed in such a manner that heat absorption is spread evenly over all

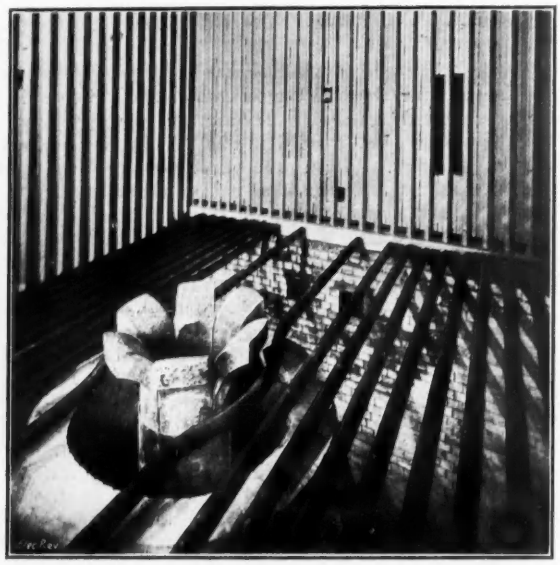


Fig. 3.—Interior of Combustion Chamber at Derby, Showing " Volcano " Burner.

sections, resulting in maximum heat transfer. A system of special baffling in the steam and water drum separates water from the steam generated in the boiler. The steam generators were supplied by Combustion Steam Generator, Ltd.

The boilers are fitted with " M.L.S." convection superheaters, each of 1,580 sq. ft. heating surface, constructed by the Superheater Co., Ltd. They are carried from the structure supporting the boilers, no weight whatever being imposed upon the boiler tubes.

Feed-water economisers serving the new boilers are of the Foster steaming type, manufactured by Eco Power, Ltd. They consist of a series of tubular elements, the tubes having cast-iron gills shrunk on the outside to increase the heating surface and to protect the steel tubes from damage by the gases. Air preheaters, which also form part of the flue-gas heat-extraction equipment, are of the " Usco " plate type, supplied by the Underfeed Stoker Co., Ltd. New draught plant and dust collectors have been supplied by Messrs. Davidson & Co., Ltd.

The latest addition to the Derby generating plant is a 20,000-kW turbo-alternator, fig. 2, 6,600 V, 3-phase, 3,000 r.p.m., installed by Messrs. C. A. Parsons & Co., Ltd. A patented system of ventilation is applied to the alternator, in which the cooling air enters the stator along its whole length and circumference, giving a highly efficient and uniform cooling effect.

The turbine is believed to be the largest single-cylinder machine running at 3,000 r.p.m. ever supplied in this country. It is essentially a high-efficiency machine, and by the use of the duplex exhaust it is able to take full advantage of the vacuum of 29 in. with which it works. The blade heights vary from $1\frac{1}{2}$ in. at the inlet, where the rotor is of 22 in. diameter, to 15 in. on a rotor diameter of 44 in. at the final exhaust. The condenser is of the surface two-flow type, having an interior cooling surface of 19,250 sq. ft., and comprising 6,130 tubes, each $\frac{3}{4}$ in. in external diameter. The quantity of cooling circulated is 16,800 gallons per minute.

In keeping with the whole of the e.h.p. switchgear in the works, that supplied by the British Thomson-Houston Co., Ltd., for the new 20,000-kW set, fig. 1, is of the back-to-back double-bus-bar type accommodated in cellular-type stone cubicles. An extension to the building had to be made to accommodate the latest equipment. There is a glass-tread gallery surrounding the switchgear at such a level as to give easy access to the isolators and bus-bars. The whole of the work covered by the extensions has been carried out to the plans and specification prepared by Mr. G. H. Lake, the borough electrical engineer.

Re-equipment of Lots Road Station.

Lots Road power house has been in use for 25 years, and it has been called upon to meet demands that could hardly have been contemplated when it was constructed. In 1908 the total car mileage on railways supplied by the station was 32,500,000; the estimated figure for 1930 is 96,250,000, an increase of about 196 per cent. In 1925 it was recognised that further additional demands on the power house could not be met adequately, except by the replacement of practically the whole of the original plant.

On the completion of the present programme the equipment will comprise nine 15,000-kW turbo-alternators, with a station load of 105,000 kW, two sets being " stand-by." A further installation of two 15,000-kW sets is contemplated. Thus far the work actually effected is attested by the output from the power house having been increased from 70,000 kW in 1925 to 90,000 kW in March, 1930. By the autumn of the present year the output will be 95,000 kW. Increase in capacity has been accompanied by a commensurate increase in efficiency.

The original equipment comprised eight turbo-alternators of 6,000 kW capacity each. Three extra sets, each of 15,000 kW, were installed, the first in 1915, another in 1921, and the third in 1925. Since the latter date, three of the old 6,000-kW sets have been removed and replaced by three 15,000-kW machines. A further 15,000-kW set is now in course of erection, fig. 5, displacing a fourth 6,000-kW set. The two latest

Fig. 4.—Portion of Lots Road Boiler House; Construction Work on Right.

large sets are working at a higher steam pressure (275 lb. per sq. inch) and temperature (650 deg. F.). All the turbines at present in the station were supplied by Messrs. C. A. Parsons & Co., Ltd.; three of the alternators were supplied by the Metropolitan Vickers Electrical Co., Ltd., and the remainder of the alternators are of Parsons manufacture. The efficiency of the new sets is about 22 per cent., and the station is at present running at 16 per cent. efficiency.

The whole of the e.h.p. switchgear is being replaced, the new switches having a rupturing capacity of 750,000 kVA. Over half of this work has been completed to date, including the provision of more ample bus-bars, together with a ring-main bus-bar. Generator reactors are being installed.

An entirely new e.h.p. control board has been erected in a new room, fig. 6, at the eastern end of the engine-room building, and the existing control board on the gallery will be dismantled. The d.c. auxiliary board has also been transferred to the new control room, and is in service in that position. The whole of the electrical system of the power house and feeders will shortly be controlled from the new control room. An illuminated diagram will be provided, giving automatic indication as to which feeders supplying sub-stations are "alive." A complete new telephone equipment will shortly be installed in the new control room, giving direct communication to all sub-stations and traffic controllers. The control equipment was manufactured by the British Thomson-Houston Co., Ltd., to the design of the electrical staff.

The old auxiliary equipment operated at 220 volts, a.c., but this is being changed over to 440 volts, a.c., and the auxiliaries on the two latest turbo-alternators are working at the higher voltage.

The original boiler equipment consisted of 64 Babcock & Wilcox land-type boilers, each of a capacity of 16,000 lb. of steam per hour at a pressure of 200 lb. sq. in. and a temperature of 500 deg. F. Eight new boilers, of the C.T.M. type, made by the same firm, have been installed, four in 1922 and four in 1925. All these have a capacity of 39,000 lb. per hour at 290 lb. sq. in. pressure and 700 deg. F. To facilitate the general reconstruction, without reducing the output from the station, four new C.T.M. boilers have been erected outside the western end of the boiler house. These have a capacity of 50,000 lb. per hour each, at the higher pressure and temperature, and have been in service since 1927.

To date, sixteen of the old boilers have been removed and replaced by eight new ones of 50,000-lb. capacity, working under the higher steam conditions, and supplying the two latest turbines. The remaining boilers are at present working on the lower-pressure steam system. Eight further large boilers (of 50,000-lb. capacity) are in course of erection, fig. 4, replacing the second batch of sixteen old boilers which have been removed. All the new boilers are equipped with balanced-draught equipment, the 50,000-lb. boilers having compartment-type stokers. Each boiler has a superposed steel economiser.

The old system of handling ashes by means of skips has been replaced by a water-sluicing system, discharging into a sump built in the yard at the west end of the power house. From this sump ashes are grabbed by a telpher crane, and can be either passed through screens for sizing, or discharged into barges in the Chelsea Creek. All the new boilers discharge direct into the new sluice, while ashes from the old boilers are at present being tipped into the sluice. The ash-handling plant was supplied by the Underfeed Stoker Co., Ltd.

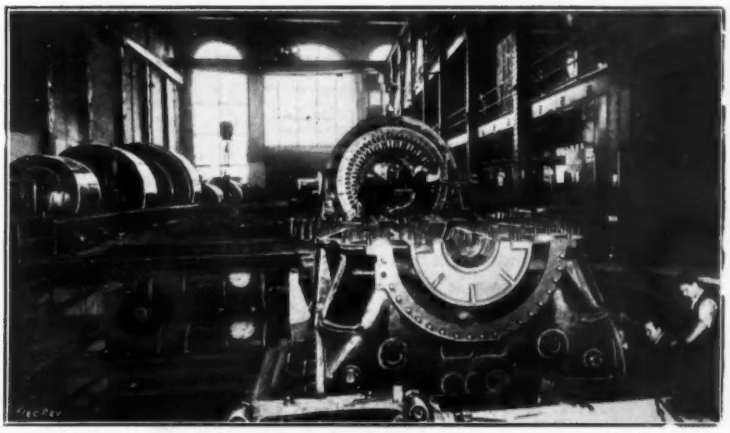


Fig. 5.—15,000-kW Set under Construction at Lots Road.

Two electrically driven boiler feed pumps and one steam pump are in service on the higher-pressure steam system, and these have a duty of 40,000 gallons per hour. A third new electrically driven feed pump (28,000 gal. per hour) is in service on the lower-pressure system.

The two old intake pipes, each 5 ft. 6 in. in diameter, in the river bed, have been replaced by one new 9 ft. diameter tunnel, 30 ft. below the river bed. The screens in connection with this intake system have been replaced by larger ones, the pit having been made 6 ft. deeper. A new outlet system, discharging into Chelsea Creek, has necessitated the construction of a number of weirs in the bed of the Creek. The intake and discharge orifices of the 7 ft. 9 in. diameter tunnel have been entirely rebuilt. This tunnel serves two large machines at the west end of the engine room.

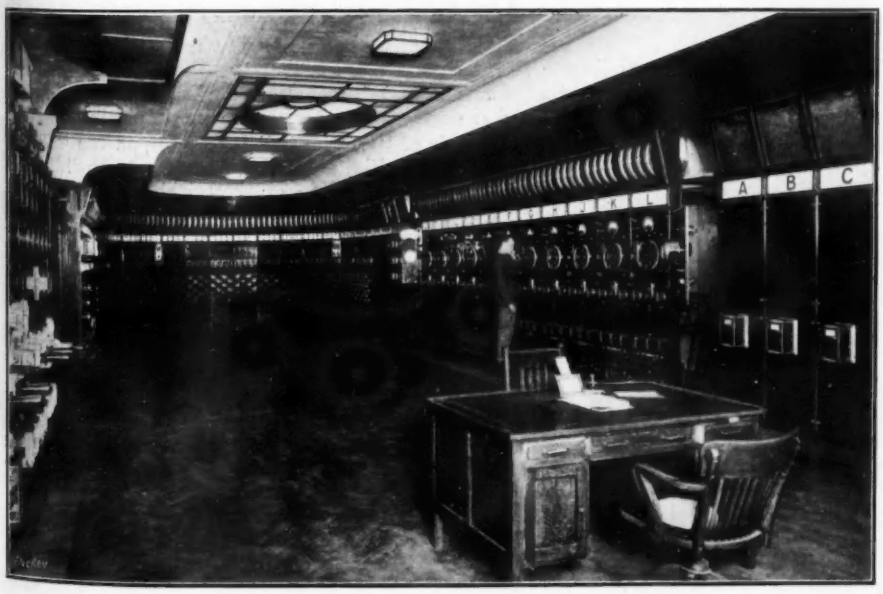


Fig. 6.—The New Control Room at Lots Road.

To facilitate the handling of material during reconstruction of the boiler house, a luffing crane has been erected on the other side of Chelsea Creek opposite the boiler house. This land will eventually be occupied by additional coal-handling plant. A new artesian well has been sunk in the yard at the east end of the power house, and is fitted with an electrically-driven centrifugal pump. Plant has also been installed for the purpose of injecting chlorine into the circulating water as it comes from the river.

The Training of Electricians.

Particulars of a scheme evolved by the City and Guilds of London Institute, the Electrical Contractors' Association, and other Educational Authorities.

By J. A. KENDRICK.

THE City and Guilds of London Institute has held examinations for wiremen and installation workers for many years past, and it has recently taken a step forward by including in its programme a scheme of courses and examinations in electrical installation work that should do much to help the installation engineer. The scheme was drawn up by an influential Advisory Committee formed jointly by the Institute and the Electrical Contractors' Association, and including representatives of the industry and the Board of Education, the Association of Education Committees, the County Councils Association, the Associations of Technical Institutions, of Principals of Technical Institutions, and of Teachers in Technical Institutions. The basis of the scheme is that the student shall attend a properly co-ordinated course of instruction which has been approved by the City and Guilds of London Institute, but provision is made for the external student who is employed at a centre where no approved course is available, or is prevented by the hours and nature of his employment on electrical installation work from attending such a course. Such a student has to apply to the Department of Technology, City and Guilds of London Institute, 29, Roland Gardens, S.W.7, before the end of February in the year in which he wishes to present himself for examination, for acceptance as an external candidate, and he must forward a statement from his employer if he has been prevented from attending classes owing to the nature and hours of his employment.

The first step in the training of the installation worker is provided for in " Course A " for junior electricians. There have been in existence for many years in certain parts of the country junior technical courses which boys of from 14 to 16 years of age have been encouraged to attend in order to prepare themselves for more advanced technical instruction after the age of 16, but the bias of the instruction given in these courses has through a combination of circumstances tended to produce mechanical engineers, and they have not included instruction more definitely applicable to electrical work. The " Junior Course A " is designed for boys who definitely intend to enter upon electrical work, although the first year of the two years of the course is of a general nature, and would be appropriate for many who might afterwards diverge into other engineering and building trades. In the second year the subject matter of the course, while still of an elementary character, becomes more definitely electrical. The course contains novel features designed to arouse and maintain the interest of the boy in electrical matters, and local education authorities are strongly recommended by the Advisory Committee to institute such a course where there are enough young students forthcoming to justify the experiment. The City and Guilds of London Institute will hold no examination at the end of " Junior Course A," but an examination would undoubtedly be held by any school or local authority responsible for such a course.

A student having passed through " Junior Course A," or having had other preliminary instruction of an equivalent standard, could enter upon " Course B " at a technical college. This course is designed to cover three years of evening instruction upon two or three evenings per week, and meets the requirements of the ordinary wireman or installation worker. The City and Guilds of London Institute holds an examination at the end of the course, which comprises two written papers each of three hours' duration. No practical examination is held by the Institute, but the latter will take into account the marks awarded by the school for practical work done by the candidate during the final year of his course, and may call for records of practical work done throughout the course. It will be seen, therefore, that practical work forms an essential part of the course, and it is to the provision for practical work that the Institute pays special regard in considering applications for the approval of courses. There are about seventy schools in the country offering instruction in electrical installation work, and at the present time about half of these have received approval under the regulations; it is anticipated that in the near future practically every school holding electrical installation work classes will have applied for, and have received, approval, so that most apprentices should be in a position to attend an approved course.

Great stress was laid by the Advisory Committee upon the need for training apprentices in the writing of clear and concise English, the making of sketch plans, and the reading of drawings, so that a man can be sent out to a job by his employer with the full knowledge that he will be able to convey his requirements for material, or instructions, intelligently to the storekeeper and also to make a report upon which an estimate can be based, or to make a rough drawing from which a new part can be provided. It was thought to be of the utmost importance that apprentices should be trained to express themselves clearly, and to study trade catalogues and terms, as much time is now lost through the inability of wiremen and installation workers to make simple sketches or to express themselves in simple language.

The whole of " Course B " is based upon the " Regulations for the Electrical Equipment of Buildings " issued by the Institution of Electrical Engineers, with appropriate ancillary study of arithmetic, electricity and magnetism, and hand sketching and drawing; the examination held by the City and Guilds of London Institute at the end of the course will be of a standard between that of the former " Grade I " and the former final examination.

The total marks for the whole examination at the end of " Course B " will be allotted in the proportions of 70 per cent. to the two theory papers set and marked by the City and Guilds of London Institute, and 30 per cent. to the practical work done in the final year of the course. A candidate who satisfies the examiners will be awarded an " Electrician's Interim Certificate." The certificate awarded to an external candidate, for whom, of course, no practical marks can be forwarded by a school, will be endorsed " Theory only."

A candidate engaged upon electrical installation work who has obtained the Interim Certificate (whether endorsed " Theory only " or not), and whose practical training and work are approved by the Advisory Committee, will be awarded the " Electrician's Certificate," which will be endorsed by the chairman of the Advisory Committee.

For the student aiming at one of the higher positions

in the industry, such as that of a supervisor, there is provided "Course C." This is an extension of "Course B," and also deals with the erection and running of electrical machines. The conditions of examination and certification are the same as for "Course B," the titles of the certificate awarded at the end of this course being "Electrician's Interim Extra Certificate," and that of the certificate awarded to a candidate whose practical work and training have been approved the "Electrician's Extra Certificate."

This scheme of training should raise the standard of work in the industry, and is worthy of the serious attention, not only of employers and employés, but also of local education authorities. If thoroughness and goodwill are brought to bear on it by all concerned, it should ensure a bright future for installation work.

The New Madame Tussaud's.

An Outline of the Lighting, Heating, and Ventilating Installations, from an Engineering Point of View.

By J. H. MAUDSLEY, A.M.I.H.V.E., chief engineer.

VERY few people, I venture to suggest, who remember the old Madame Tussaud's can imagine the great changes which have taken place within the walls and on identically the same site. Before the fire in 1925 the site was occupied, in the main, by the waxworks exhibition. True, there were pictures of a kind, and catering was done to a small extent, the pictures being a side line and free of charge. The new Madame Tussaud's building embraces a spacious super-kinema with accommodation for nearly 2,000 people, a first-class restaurant with seating for 500, and the reorganised waxworks exhibition, each under separate management, but with unified control of the whole.

From an engineering viewpoint the plant and equipment have several unusual features. Electrical energy is taken from the St. Marylebone Council's mains at 6,600 volts and transformed on the site by three single-phase transformers, each of 500-kVA capacity, to 415 volts 3-phase for power, and to 240 volts single-phase for lighting (with neutral). A direct-current supply is also taken from the Council on the 3-wire system, giving 480 and 240 volts, also for power. The kinema plant comprises duplicate generator sets, each of 60 kW, driven directly by 3-phase motors, wound-rotor type, at 415 volts, each of 89 h.p. They are operated by triple-phase oil breakers and controller-type starters. The generators supply current to the projection room for three film projectors, two with talking-film equipment and one silent, two spot lamps and one slide lantern, the total bioscope load being 46 kW. They also supply a duplicate motor-generator set for the sound-film apparatus and all "secondary" lighting throughout the building at 100 volts, d.c. Figs. 1 and 2 show, respectively, the projectors and the front of the sound-film amplification panel, and the back of this panel.

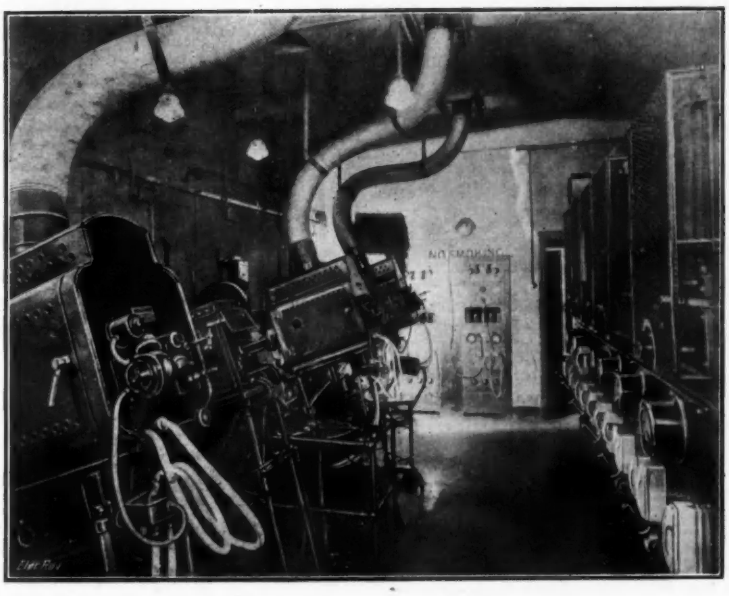


Fig. 1.—Projector Room: Sound-film Amplification Panel on Right.

In the event of a failure of the generators from any cause, a storage battery of 500 ampere-hours capacity, standing fully charged on open circuit, would automatically be tripped in to feed the main switchboard. The voltage on discharge of the battery would also be automatically controlled by a special battery-governing switch, feeding in cell by cell and maintaining a uniform voltage until the battery was completely discharged. A duplicate booster charging plant is of the twin-machine type, the motor and booster being directly coupled on one bed plate. The motors are connected to the 3-phase supply at 415 volts and are of the squirrel-cage type, the boosters being connected to the busbars of the main board through the usual switchgear. The kinema is complete with an elevating orchestra and organ console. These are each on separate power units, hydro-electrically operated by push-button. Three controls are provided on each to raise, lower, and stop in any intermediate position, and both equipments may be operated in unison. The entire orchestra platform, measuring 32 feet long by 10 feet wide at the centre, accommodating 24 musicians with their instruments and grand piano, is elevated by a ½-h.p. motor, rising through 10 feet to the stage level.

The stage lighting is controlled by a special dead-front type board, all the dimmers, &c., being mounted at the back. Metal dimmers are provided for the four-colour lighting on the stage float, two battens and orchestra float, with liquid-type dimmers for the two stage dips on four colours also. The dimmer control is by individual hand and master hand, and all metal dimmer elements are continuously rated for their respective loads. Two perch arcs are also controlled from the board, and the whole stage lighting is master-controlled by a triple-phase oil circuit breaker with

push-button trip for "black out." The lighting system throughout the building is indirect, all the fittings being of special design and manufacture. In the kinema a motor-driven dimmer controls the auditorium lighting, with emergency pushes at two points in the house and one in the projection room, which cut out the dimmer and instantly put the lights full on. The contactor switches, closed by the emergency pushes, must be hand released before the dimmer can again be used. Front elevation lighting by sky signs in 5-ft. letters, using 20-watt "daylight blue" lamps, gives a striking note to the contour of the building. This is further outlined by recently installed neon-tubes, the top line of 288 ft. being, it is claimed, one of the longest single lines in Europe. This addition was erected by Messrs. Electrolumination, Ltd.

The heating and ventilation system is in reality in three separate parts, the kinema, restaurant, and exhibition each having its own inlet, extraction, air-washing, and humidifying gear. The inlet portion of the plant is housed in one apartment, together with the pumping sets in connection with the washers, sump, &c., and all three have their air supplies from one main intake. The air-washer water is electrically pumped into each washer individually from a manifold or header at 150 lb. per sq. in. pressure. Returning from each or all of them, the water enters a settling tank and passes through three strainers before being again circulated. To the water in the settling tank is added, by drip feed, a de-odorising concentrated liquid essence which gives a faint, but pleasing and refreshing, odour to the circulated air. In winter the washer water is steam heated in order that no appreciable temperature drop should be experienced in the washer, which would be the case if air was passed through atomised water at a temperature considerably lower than the pre-heater portion of the battery. From the re-heater section of each battery the conditioned air passes through centrifugal fans of the downcast type and is delivered to underground ductwork, and so distributed through regulation grilles in the various sections of each part of the building. The kinema extraction system is by metal ducts picking up a series of grilles in the main ceiling, the ducting being connected to a centrifugal fan which discharges to atmosphere.

The restaurant extraction system is on a similar principle, the fan being of the box-blade type. The kitchen has separate inlet and extraction centrifugal fans, the inlet air being uniformly distributed and taken from an independent source. The exhibition extraction system is by a number or separate fan units of both the centrifugal and box-blade types. They deal individually with the respective exhibition halls. All centrifugal fans are belt driven by shunt-wound motors, with field regulators. To comply with the requirements of the L.C.C., each plenum fan motor is master controlled by an hydraulically-operated switch. This remains open, and the motor cannot be run until its respective air washer is in operation and the switch thereby closed. The kinema plenum and extraction fans are electrically inter-connected in such a manner that the extracter cannot be run until the inlet is first started.

The heat for the building, except the organ chambers, is supplied by a battery of six sectional water boilers, three for the kinema, two for the exhibition, and one for the restaurant. Each section has its own accelerating pump, and the heating battery and radiators of each portion are valved, so that either or both may be shut off. There are also two vertical steam boilers to supply the various cooking units in the restaurant kitchen, and also to supply domestic hot water through a coil-heated calorifier of 500 gallons capacity. The whole boiler plant is equipped with induced draught through the medium of a centrifugal motor-driven fan located at the head of the stack. A change-over hopper in the stack enables the boiler-house to work on either natural or induced draught, as occasion demands. Both the fan and hopper are controlled from the boiler house. The condensed water from the calorifier is used for boiler feeding, electrically pumped, and also, by a separate arrangement, for storage-battery purposes. In the case of the organ chambers the heating is electric. A constant and uniform temperature throughout the year was demanded by the organ builders to ensure the highest musical results from the mass of complicated mechanism. Electric tubular heaters are installed in each apartment and governed by one thermostat. This can be pre-set within a range of temperatures, and it opens or closes the heater circuit accordingly. It has, in practice, been found that the arrangement works very satisfactorily, the temperatures in the chambers varying only three degrees with an outside variation of 18 degrees. To assist in the efficient and economical running of the heating plant a system of electrical distance thermometers is installed. It is of the type in which the temperature of each apartment can be read direct on a graduated scale in degrees F., and a chart record made on which the temperature is recorded, in colour, every three minutes.

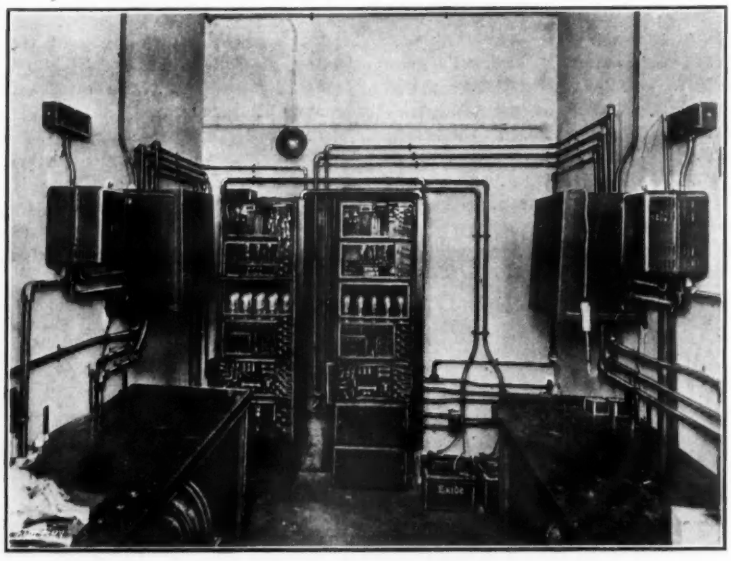


Fig. 2.—Back of Sound-film Amplification Panel.

The whole building is vacuum cleaned from a central plant of the Sturtevant Co.'s manufacture. The pipe work is in one continuous whole, the nozzle connections in each part of the building. The cleaner is driven direct by a d.c. 12-h.p. motor. A cold-storage apartment, in the basement, for the use of the catering department, is equipped with electrical refrigeration. By thermal control this apparatus maintains a temperature in the chamber of from 32 to 34 degrees F. During the heating season there is a daily average of 24 electric motors on various duties throughout the building. The whole of the engineering installation is maintained in good running order under excellent general conditions, and at high efficiency. The engineering staff at Madame Tussaud's, working under the direction of the author, numbers about twenty.

Patrons of Madame Tussaud's whose memory carries them back to the old Exhibition, that is, prior to the fire in 1925, can easily be excused for marvelling at the change which has been brought about in the building, in the waxworks exhibition, and the other attractions, both in quantity and quality.

Vehicle Lighting Problems.

Notes on Variable-speed, Constant-current, and Constant-voltage Dynamos for Motor Cars.

By "THIRD BRUSH."

IT is rather remarkable, considering that variable-speed dynamos outnumber all others, to find that hardly any standard textbooks on d.c. machinery, either elementary or advanced, make even a passing reference to them. The following notes on their operation apply chiefly to motor car and 'bus work, but similar general principles hold good for train lighting and also (if one may say so without ridicule) for windmills other than those using induction generators.

For many years two radically different systems of controlling the dynamo output have been used on private cars and (more recently) on commercial motor vehicles, and heated arguments on their respective merits still continue. These two systems are referred to as the c.c. (constant-current) and c.v. (constant-voltage).

The c.c. dynamo takes advantage of the characteristic of the accumulator through which a slight increase in applied voltage above the normal causes a relatively large increase in charging current. This increase in current is utilised to weaken the dynamo field and so prevent a rise in current beyond the rating of the machine. Many ways of weakening the field have been devised at various times, involving strange compound-winding arrangements, ballast coils, auxiliary poles (wound and unwound), external regulators (not to be confused with voltage regulators) and several other methods, some of them more ingenious than useful. Nearly all these have disappeared, and armature reaction alone, in conjunction with a third brush, is now used for controlling the field. This is applied in two quite distinct ways. In the first and best known method the field is connected, not across the main brushes, but between one main brush and an auxiliary brush having an intermediate position in front of that main brush in the direction of rotation. Thus an increase in armature current, by distorting the field in the direction of rotation, as in a constant-speed machine, causes a reduction in voltage across that portion of the commutator to which the field is connected. The second type of c.c. dynamo, developed very successfully by one well-known manufacturer, has its field winding connected across the main brushes and the third, or "control," brush is short-circuited to a main brush which is behind it in the direction of rotation. The effect of this is that, as the speed becomes greater and the neutral plane consequently advances, the current flowing between the two latter brushes gradually decreases to zero and then, on further acceleration, the third brush current begins to increase in the reverse direction. The field set up by the short-circuited armature coils therefore assists the main field at low speeds and opposes it at high speeds. This principle is favoured by some designers as facilitating a low cutting-in speed and reducing armature heating effects through the peculiar distribution of current in the winding. It has also the important characteristic of maintaining the output curve almost level at all speeds above that at which it attains its maximum. The first type, on the contrary, falls off in output appreciably at high speeds, which under some conditions may be a serious disadvantage. It is evident that if the armature current did remain constant after the peak the resultant field strength would eventually become zero, which, in the language of Euclid, is absurd. One way of overcoming this trouble is to use two field windings, one connected as before and the other across the main terminals, the two being cumulative in polarity. By suitably proportioning these windings the characteristic can easily be made more or less flat as desired. Somewhat akin to this is the method occasionally found of arranging the two windings differentially, one as a plain shunt and one between a main brush and a third brush *behind* it in the direction of rotation. As regards four-pole generators, nowadays commonly favoured for vehicle use on account of their smaller weight for a given output and other advantages, a double-field winding is much easier to apply than the short-circuited brush.

The constant-voltage system presents entirely different problems. It consists essentially of a plain shunt-wound generator provided with an external regulator which maintains the voltage within very close limits at a predetermined figure, about 15 volts for a six-cell lead battery. The regulator is usually of the magnetic vibrating class acting, like many central station patterns, by periodically short-circuiting a resistance in series with the field. Other designs have also been adopted using thermostats or carbon piles to which pressure is applied through springs opposed by solenoids connected across the dynamo terminals. The action is frequently modified by a second coil, or thermal device, in series with the dynamo which limits the output to a safe amperage if the battery voltage happens to become very low. With such a safeguard the system is practically foolproof so long as the regulator retains its correct setting. The regulator is necessarily somewhat delicate, as it must function on very small changes in wattage, and, unlike many station regulators, it cannot be controlled by gravity.

We will now consider the chief arguments employed by advocates of the rival systems.

The champions of constant current contend that :—

(1) The c.c. system is simpler and cheaper, if we consider dynamo and regulator as one, as no one has yet devised a variable speed generator which will give a constant voltage without the help of some extraneous regulating device, and such device needs highly skilled manufacture if it is to function for long periods without adjustment.

(2) If the battery becomes sulphated the dynamo voltage will rise sufficiently to break down the sulphate, whereas the higher internal resistance of the battery might in such a case prevent a c.v. dynamo from charging at all.

(3) Most garage mechanics can adjust the output by moving the third brush, while few can deal with a voltage regulator, a very small error in the setting of which might cause serious damage to dynamo and battery, and for this reason the regulator is usually sealed by the makers.

The points advanced in favour of constant voltage are :—

(1) The charging rate is a maximum when the battery is discharged and falls to a trickle when it is fully charged; most c.c. dynamos, on the contrary, actually increase their amperage as the battery voltage rises, so that the life of the battery may be much shortened.

(2) In an emergency the generator can supply the lamps with the battery out of circuit, while with a c.c. set a broken connection between dynamo and battery commonly burns out the lamps and sometimes causes a serious accident.

(3) The generator can be designed on more efficient

lines and is less liable to sparking trouble, as it does not rely on field distortion for its regulation and has no third brush placed in a strong field. It must not be forgotten, however, that one designer has evolved most excellent c.c. dynamos which do not distort their fields. As regards efficiency in the sense of watts per horse power, all variable speed generators are naturally more or less inefficient, and three-brush machines particularly so, but this is of minor importance as the power absorbed is in any case a minute fraction of the engine power.

(4) The life of the bulbs is longer, as the voltage can never exceed the predetermined maximum. This is very debatable. Properly chosen bulbs certainly have a long life on c.v. sets, but by correctly proportioning the various components a c.c. installation can give, in the writer's opinion, equally good or even better results in this respect.

In this country at present c.c. holds practically the entire field for private cars and also for railway work, while c.v. is used on about four-fifths of our 'buses. English 'bus companies contend that under the severe conditions of commercial working c.v. is more reliable and cheaper to maintain, as it does not leave control of battery charging to the discretion of the driver. It must be remembered, however, that 'bus installations, unlike those of private cars, are regularly tested by properly instructed electricians. In America, where c.v. was formerly used extensively on private cars, it has been almost ousted by c.c. On the Continent opinion is more or less equally divided, and a large proportion of Continental makes marketed in England have c.v.

In recent years a lighting system has been developed which combines the advantages of c.c. and c.v. without the disadvantages of either. It has a c.c. generator working in conjunction with a "controller" which automatically inserts a resistance in the field circuit when the battery voltage reaches its fully-charged figure. Several types of these controllers are now in use, but one of them is, in the writer's opinion, distinctly superior to any other. In the latter the vibrating action usually found in such instruments is entirely avoided, the voltage at which the contacts are broken being appreciably below that at which they are closed. In addition the shunt winding is opposed by a second winding in series with the lamps, so that the dynamo always gives its full output when the lamps are in use.

This system, like the c.v., dispenses with the necessity for a hand-operated charging switch, a fitting which is almost useless even to an engineer driver, as there is nothing to indicate when it should be used. But as compared with c.v. it has the advantages, among others, of freedom from delicate mechanism, ability to deal with a sulphated battery, and easier maintenance. It can neither burn out the lamps if a battery connection breaks nor overheat the dynamo if the battery voltage is very low. Under the most severe commercial conditions it has met with great success, but on private cars it is not yet much in evidence. Even allowing for the fact that in these days of mass production every shilling added to the cost per car is a serious matter, many car makers have a curious apathy towards improvements in electrical gear. If some of them knew how much goodwill they lose through needless deficiencies in this direction they would soon give more thought to such questions.

The English Essay for the I.E.E. Examination.

A little thought and an understanding of the examiner's requirements make all the difference between a loose collection of ideas and a clear-cut essay.

By 'RIC.

ENGINEERS are strangely reluctant to write a line more than can be dragged from them by sheer necessity. Even technical reports to their own chiefs are written with an economy of words, or mis-use of them, that reveals a loathing of the job. When he has to write an essay for an examination, the engineering student usually finds himself in a quandary, not because he is the illiterate mechanic of the popular novel, but because his technical studies have kept him from newspapers, recent books, and topical small-change conversation. He feels he has nothing to say and, pressed for time, leaves the English paper to take care of itself, hoping that particularly good work on mechanics will give a sufficiently high factor of safety. Three weeks before the examination he suddenly realises that, not only must he write something, but also that his English paper must counter-balance shortcomings in "Magn. Elect.," and English is such a vague thing to study unless he goes back to elementary grammar. Once more, with revision work piling before him, he is tempted to let it go and trust he will be able to "jot down something" when the time comes, and this is fatal. Moreover, while everyone expects to be floored technically, it is humiliating to be handicapped by mere inability to convey the little one does know. It is probable that in Part 2 of the examination—particularly the generation and distribution section—questions requiring short accounts of plant-layouts and discussions of station and system economics will predominate.

Before writing a word, try to appreciate the point of view of the man who will mark your paper. In the syllabus he asks for one essay—two if you like—but because it is labelled "essay," he does not expect a well-rounded, highly polished gem of rhetoric, bristling with epigrams and resonant sentences; that were impossible in the time allowed. One of the great writers is said to have spent a whole day refining one sentence—but not in the examination room. The examiner wants from you a clear and simple communication of ideas based upon facts. He does not want pretty writing—embroidery—but he does expect something more connected, more thoughtful than a catalogue. He wants you to write in such a manner that he can understand, with little effort, what you are writing about; do so.

You need three things: a subject that sets you thinking; the ability to summarise ideas in a few brief headings; and the time and cool-headedness to think before you write. Subjects are of two classes, technical and general, but you are not bound to treat either in a severely technical or "man-in-the-street" fashion. An engineering subject is not necessarily the safer one to choose, just because you are an engineer. Unless you plan your work very carefully indeed you may exhaust your technical material halfway, and be forced suddenly to change your line of attack in order to keep going. That reveals a lack of system and a disorderly mind—which the examiner will pounce on; a multitude of epigrams will not cover that glaring error. Consider the problem of smoke-abatement; must you drop the subject because you have not studied combustion, or can you find enough material to work from the point of view of the man who wakes,

morning after morning, to find his windows covered with soot? Or the Channel Tunnel; will you be the expert who tells us the bed of the Channel contains the ingredients of Portland cement, or the public-spirited enthusiast who would like to take a train to Paris for the week-end, but rather fears the possibility of invasion? You must decide before you write even the title of your essay.

Remember the examiner always; treat him as partner to a spirited, but friendly, discussion. Foresee his answers to your statements; answer all his questions. Assume from the beginning that he takes exactly the opposite point of view, and argue the thing out, pleasantly but convincingly. Go at it as though you mean it and, at the end, be sure you have the last word, while conceding that your imaginary opponent has made a few helpful points. Never finish by implying: "this is just my point of view, and, of course, I may be wrong." The more you enter into the spirit of it, and determine that the other man shall not prevent you from boring a tunnel, the more convincing will be your essay—your talk; provided you remain courteous, and write at least so legibly that the examiner can read straight through, missing none of its force by having to turn back.

Avoid the type of subject that calls for a list of events. "A Summer Holiday—'Then we went . . .' 'After that . . .'; 'In the afternoon. . . .'" It looks so easy and interesting, but you must be a good letter-writer, and have exceptionally vivid recollections to succeed. Choose, rather, a subject that puzzles you a little, sets you thinking. Once you start to think nobody knows where you will stop, and if only you will have the patience to put down, say, six headings—you can scribble them on the back of the question-paper—to act as guides and keep you to the point, you will have done the hardest part of the morning's work. Do not make too many notes, or lengthen each into an essay by itself. The more terse, the more suggestive they will be as, one by one, you pick them up, pull them to pieces, answer—again—all the unspoken questions of your reader, and drop them till, naturally and easily, you reach the end. You need not laboriously "round it off", it will finish itself. But it will not write itself; you cannot "just sit down and write out of your head."

Do not attempt to write for the first half-an-hour. It will give you an uneasy feeling to think that others have written two whole pages before you have started, but they may have been fortunate enough to find a subject they have used before and know by heart—that may happen to you. Or, unwise, they may sooner or later reach that exasperating point that leads nowhere and suggests nothing, yet has arrived far too early to be the conclusion of the essay. If you reach that stage, through starting in a hurry, you will have to decide whether to scrap everything and start again, or make a clean break by opening an entirely new line of thought with a fresh paragraph. You will be fortunate if you are able to do that; at any rate, you will lose marks.

Start the essay at its natural beginning. We dearly love to circle about and around to avoid giving things away too soon. We like to start with some general remark that has a connection as remote as possible with the subject, and gradually—through five pages of foolscap—lead to the main point; that is unworkmanlike. You dare not talk to your personal friends in that way, so do not risk it with the examiner; he is bored enough already with the other fellows' essays. This is a law, rigid, inflexible: to state the case, then discuss it, is right; to begin—somewhere—and gradually emerge, through a fog of words, to a conclusion which the patient examiner has seen, and has been waiting for you to make since the first paragraph, is utterly wrong. Obey this, and the fear of space will vanish; only your notes will prevent you writing too much.

There is no need to worry about the choice of one long essay or two short ones, or to assume that if you submit only one it must be very long, and impossibly good. Think of one thing at a time and write the first essay before you choose the second subject. You will lose nothing by writing an essay and a quarter, or only three-quarters of one essay, but convey the impression that you have at least tried to give the examiner what he asks for. Do not send in half an essay, obviously too long to be finished in four hours, and—equally obvious to the examiner—never intended to be finished, and already half-full of "padding." Padding is the black art of using clumsy words and involved sentences. Words of any length, used in the right places, are right; long words, used to replace many overworked short ones, are right; but long words used because they are long, and look well, are wrong. Start each sentence at its proper beginning—end each with a significant word. French and Latin tags are necessary—sometimes; distrust them when they slip readily from the tongue into an awkward place. It may be a sign that your ideas are muddled concerning both your subject and the true meaning of the tag. "Etc." is unnecessary at the end of a complete list, and implies lack of knowledge after a single example; leave it out. The examiner sees through that straight away.

Never try to bluff the examiner. He may not know the difference between an ampere and an ammeter, but he will know whether you know or not. Be sincere; never try to "make up things as you go along." Practised writers will not do it, and you cannot. Forced humour and cynicism cannot replace knowledge and clear reasoning. Real spontaneous humour may put the examiner in a good mood, but keep it under control. Have the courage of your convictions, but do not say what you do not mean because it would be so daring and clever if only you did. The examiner knows.

The examiner knows when you are trying to impress him with your style, or a style you have tried to borrow from a newspaper or novel. Style is a thing you must try to forget. It is the way you say things, apart from conforming to the simpler rules of grammar. It is fixed for long periods, and cannot be altered in three weeks without becoming artificial. Affected style is self-conscious style, and it is your job to forget yourself in your subject and your reader. This does not mean you are to cloak your opinions, either from false modesty or moral cowardice, behind the universal "one." It is better to say: "You may use the first person, and I advise you to do it," than "One is not advised to use the first person, although one is allowed so to do." Avoid ungainly precision.

Idioms and slang expressions should not be used unless they are really needed to strike home a point; try standard English first, in your own mind. Avoid exclamation marks, and underline nothing but the title of the essay; let emphasis be natural. Refrain from asking unnecessary questions of the world in general, like a Hyde Park orator. Shun "abouts" and "possibilities"; state facts, or admit that you do not know. Be careful with the word "therefore." It slides comfortably into position before the conclusion of every little argument, begins to bore, and soon loses meaning; when you really need it, you find it is worthless. Note that you may use "so" or "therefore," but never "so, therefore." Have pity for the overworked comma; learn to use semi-colons and short sentences.

Resist the temptation to raise simple technical phrases to the heights of beautiful prose. "A one-kilowatt bowl fire" is correct, but "An electric heater, consuming one unit per hour, shaped like a bowl," is pedantic, fulsome, and ludicrous. It tells clearly that if you had to report to a board of directors your unnatural "polite art of writing" would hide your meaning. That is what the examiner looks for.

It is the examiner's point of view that matters. Give him a rest from weird expressions and twisted sentences, from clichés and the wearying sameness of the man who has taken a spotless piece of paper and a brand-new nib and started, straightway, to write, with a perfectly empty brain, painful, wonderful English—because it's an essay. Be careful, but be sincere. Be distinct, but be pleasant about it. Do not be over-anxious, and don't be afraid to stop when you have finished.

Electricity for the Home.

An account of the progress made in domestic electrification by the Great Yarmouth municipal electricity undertaking; new manufacturers' items.

IN keeping with the life of the town generally, the Corporation electricity supply undertaking at Great Yarmouth is "alive," as is evidenced by the progress and activities depicted in the following notes and explanatory comments.

Fig. 1.—"Electric House," Gt. Yarmouth.

The town has a mixed permanent population of some 70,000 inhabitants. Some parts are intensely industrial and others are essentially residential. As a holiday resort Yarmouth's population is increased by something like 80 per cent. during the summer months. For a few months in the autumn and early winter about 20,000 Scotch fisher folk "invade" the town and have to be catered for. In the surrounding areas included in the 1927 and 1930 Special Orders there is a population of about 60,000. These facts, coupled with the results of the initiative of the Electricity Department, render the activities of the latter a particularly interesting contribution to this section.

The two-part tariff in vogue in Yarmouth is based on the rates assessment, 20 per cent. of the rateable value, plus ¾d. per kWh, and a very large number of consumers within the borough and in the outside areas are taking advantage of it. A slightly higher price is charged in areas outside the borough boundaries, 20 per cent. of the rateable value, plus 1¼d. per kWh consumed.

The domestic side of the business is catered for in various ways. The commodious offices and showrooms which were opened last year encourage inquirers and enable demonstrations of cookers, refrigerators, cleaners and other apparatus, together with general lighting exhibitions, to be held on the premises.

"Electric House," fig. 1, which was built at a cost of £25,000, embraces the showrooms, maintenance workshops, test rooms, stores, and all the executive and administrative offices of the undertaking. Inside one is enthused with the "electric idea," and the undertaking seems to have hit on the very happy, and perhaps unusual, combination of utility and comfort, without luxury; it is essentially a business house. Display rooms—bedroom, dining room, kitchen, fig. 2, and so on—are arranged on the "cubicle" principle, and there is ample provision for demonstrations and lecture work. Adequate window-display room is also a feature. A certain amount of canvassing has been done with regard to cooker installations, as well as "assisted wiring," and progress in relation to consumers connected and kWh sold has been creditable. The total kWh sold in 1927-28, 5,600,000, has increased in 1929-30 to nearly 12,000,000, and new consumers, mainly of the domestic type, are coming on just now at the rate of 80 to 100 per week. The price of gas in Yarmouth is 1s. 1½d. per therm, and it is evident from the above figures that electricity is offered to the public on a competitive basis. Although 66 per cent. of the assessable property in the town is wired for electricity, applications from within the borough still outnumber those from outside, but as month by month the various surrounding small towns and villages are linked up it is anticipated that the proportion of country consumers will increase. The same facilities are offered as regards the hire of cookers and other apparatus, and at the same prices.

As an indication of the willingness of country folk to make use of electricity, not, of course, without selling effort on the part of the undertaking, the village of Acle may be cited. This village has a population of about 1,000. The public electricity supply was initiated in 1928. At present there are 211 consumers connected, and a number of these use the supply for cooking and heating. Most of the consumers are agricultural people, and many of the residences served are old English country cottages.

Fig. 2.—Demonstration Room in Yarmouth Showroom.

At the time of our visit to Yarmouth cooker number

1,410 was being connected up. Water-heating supply is also being encouraged by a new tariff of ¾d. per kWh, when the apparatus is thermostatically controlled. This special rate also applies to tubular heating, which has recently been installed in hotels, shops, and factories. Something like 4,700 electric fires are also connected to the network. In view of the above it will readily be understood that the percentage of domestic consumers in Gt. Yarmouth is rapidly increasing towards the 100 per cent. ideal of the engineer and manager, Mr. P. G. Campling, A.M.I.E.E. The hiring rates at Gt. Yarmouth are exceptionally low, a Jackson No. 20B being hired out at 5s. per quarter, including installation and maintenance. The newer types and " De Luxe " models are naturally in demand, but the re-conditioning of cookers which have been on circuit and the replacing of steel hobs by enamelled ones are giving satisfaction to consumers.

The undertaking does its own repair work, and the maintenance costs last year averaged 14s. 7d. per cooker, but it is hoped that with the new-type hotplate this figure will be considerably reduced this year. There seems to be a preponderance of " Jackson " stoves, but " Revo " and " Magnet " makes are also in evidence.

In connection with the " assisted wiring " scheme, one penny per kWh extra is charged to the consumer and credited against the installation costs. The occupier of the premises is enabled to claim the installation when 200 kWh per point have been consumed. There are nearly 4,000 of this class of customer on the mains, with prepayment meters, of course.

We are indebted to Mr. Campling for permission to publish the above information, and to Mr. F. B. Bell, commercial assistant, for his help in the preparation of the above notes.

New Household Refrigerators.

Kelvinator, Ltd., have recently introduced a complete new line of electric refrigerating cabinets which are claimed to represent an advanced stage in design and efficiency. All the new cabinets, which are grouped into three divisions—De Luxe, Standard, and Utility—in sizes and capacities to meet the requirements of most types of home, are equipped with automatic " Ice-O-Thermic " tubes which, it is claimed, produce ice cubes very quickly, and the freezing process is accomplished without affecting the other temperatures in the cabinet. The operation is arranged on the thermostatic principle.

The new cabinets are more massive and sturdy in design, properly proportioned, with low convenient height and attractive roll tops. They provide more space for food storage. The locks on the doors, which are pyramided for an entirely new and attractive effect, are improved for easier instant and perfect closing. Each of the new models is provided with standard condensers.

A New Fire.

Messrs. Siemens Electric Lamps and Supplies, Ltd., 38-39, Upper Thames Street, E.C.4, have recently introduced a low-priced and efficient fire, the

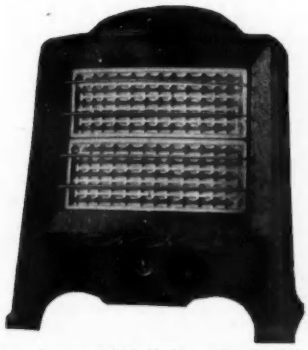


Fig. 3.—2-kW " Homely " Fire.

" Homely," fig. 3. Made in 1- and 2-kW sizes, it is finished in standard models in black stove enamel; it is also supplied in porcelain-enamelled finishes in six different colours. Each fire is fitted with an earth terminal and 6 ft. of flexible lead. The models are claimed to be suitable for some of the bigger schemes, such as municipal housing, &c., and also for hotels and similar work.

Electric Ship Propulsion.

The first example of a novel system: the combination of a reciprocating engine with auxiliary turbo-electrical equipment increases the power developed, and simultaneously reduces the fuel consumption.

THE sea trials of the Ellerman liner *City of Hong-kong* marked a notable development in the propulsion of ships, since the vessel is one of the first to be equipped with auxiliary turbo-electric drive.* The combination of a steam turbine with a steam reciprocating engine in order to utilise the potential energy remaining in the exhaust steam from the latter would seem to have exceptionally attractive possibilities for ship propulsion. In the case under consideration that energy is made available by a turbo-generator set coupled electrically to a direct-current motor that is mounted on the propeller shaft, which system is declared to have important inherent advantages.

The *City of Hong-kong* is a vessel of 12 knots, having a displacement of 18,480 tons. She was built by Earle's Shipbuilding and Engineering Co., Ltd., in 1924, and is fitted with a quadruple-expansion reciprocating steam engine developing 4,400 i.h.p. at 80 r.p.m.; she is engaged principally on the Indian service. The auxiliary turbo-electrical equipment has been installed to increase her power, and at the same time to reduce her fuel consumption, and the trial data show that a very handsome improvement has resulted. This new type of exhaust-turbine propelling machinery has been developed by the Metropolitan-Vickers Electrical Co., Ltd., in collaboration with Mr. Hinchcliffe, chief superintendent engineer of the Ellerman Lines, Ltd. The machinery was built at Trafford Park and installed by Messrs. Workman Clark (1928), Ltd., at Belfast.

One of the considerations which affect the problem of improving the performance of reciprocating engines by the addition of a coupled steam turbine is the difference between the characteristics of the two machines. The former, on the one hand, has an uneven turning moment, and changes its speed rapidly with change of load, because of its low inertia; the latter, on the other hand, has a uniform turning moment and, because of its high inertia, its speed variation with changing load is comparatively slight. It is evident, therefore, that for combining the effects of the two machines some form of flexible coupling between them is a practical necessity. Moreover, it must be capable of withstanding

* The P. & O. Co.'s liner *Mooltan* is believed to be similarly equipped, while the Bauer-Wach arrangement utilises a clutch instead of the electrical link.

without fatigue the fluctuating stresses due both to the uneven turning moment of the reciprocating engine and to the tendency towards widely differing speed variations of the engine and turbine in a seaway; the latter irregularity is by far the more important, and may lead to a load variation in the coupling of from 50 to 250 per cent. of its normal load when controlled.

Direct-current electrical machinery forms an ideal coupling for those conditions: the speed ratio (slip) can be altered at will and adjusted to the variations in speed of the two prime movers, so as to keep the load on the coupling within permissible limits; it is perfectly flexible, thus avoiding shocks on the system due to sudden load changes, and it has no feature corresponding to fatigue in mechanical couplings; in addition, it has an exceedingly high momentary overload capacity and is reversible.

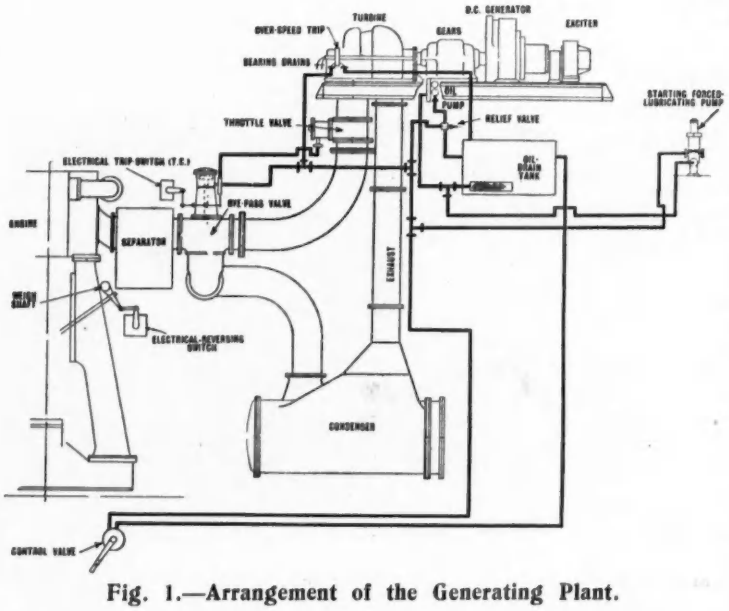


Fig. 1.—Arrangement of the Generating Plant.

peller speed be maintained in consequence in a seaway, but also, due to the steadier speed of the propeller, appreciably higher propulsive efficiency is obtained than would otherwise be the case, and, of course, the turbine efficiency is improved as well. These two facts have an important bearing on the annual fuel consumption. Loss of speed due to propeller racing and low efficiency must be compensated for by disproportionately increased power at a later part of the voyage, which leads to a high average fuel consumption. If that delay is saved, the fuel consumption will be reduced to normal, and the worse the weather the more important it is to be able to draw upon the steadying effect of the exhaust-turbine equipment.

A further important characteristic of the electrical coupling is its reversibility; the turbine remains in commission and runs in the one direction for either ahead or astern rotation of the propeller. To the advantage of increased astern power in an emergency must be added the elimination of the risk of failure of the disengaging mechanism required with a non-reversible coupling. On a similar installation, which is now in progress of construction for another vessel of the Ellerman Co., a direct steam connection to the turbine is also to be fitted, so that in the admittedly unlikely, but possible, event of a total breakdown of the reciprocator the turbine will be available for delivering power both ahead and astern. The power available from the turbine alone would enable a speed of 6 or 7 knots to be maintained at least.

It will be realised from the foregoing that the new machinery possesses novel and very interesting features, and the trial results outlined below would seem to indicate that the designers' claims have been substantiated.

Description of Machinery.—Fig. 1 shows diagrammatically the arrangement of the generating plant: the impulse turbine is supplied with steam from the exhaust

Fig. 2.—Exhaust Steam By-pass Valve.

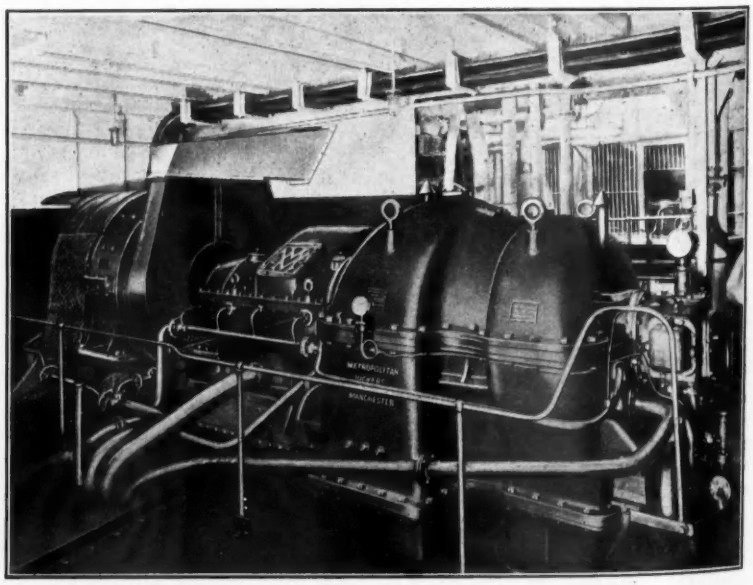


Fig. 3.—The Turbo-generator Set Installed.

It will be evident that the use of such a coupling enables the steadying effect of the turbine on the reciprocating engine to be exploited to the fullest advantage. The turbine speed can be maintained at its full value over a wide range of engine speeds, so that the flywheel effect is always a maximum and the full capacity of the electrical machinery available to reduce propeller racing to a negligible amount. Not only may a higher pro-

of the l.p. cylinder of the reciprocator through a "Vortex" steam separator. The exhaust steam is admitted through a by-pass and isolating valve: the former (fig. 2) serves to connect the engine exhaust either to the turbine or to the condenser, and is specially designed to give a low-pressure drop with the large volume of steam dealt with. A separate isolating valve is included because the conditions to be fulfilled by the

by-pass valve were considered to be incompatible with those of an isolating valve. The existing condenser has been retained, but modified to deal with the increased steam volume at the higher vacuum. A new circulating pump has been added to provide that vacuum in conjunction with the existing air pumps, assisted by a Mirrlees Watson vacuum augmenter.

The two generators (main and auxiliary) together give

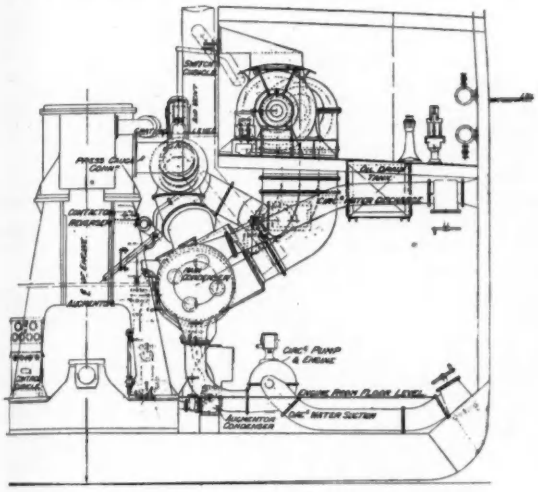


Fig. 4.—Lay-out of the Turbo-generator Set.

the plant the characteristics required; they are driven through single-reduction double helical gearing, to which they are joined by a Wellman Bibby coupling to give the necessary flexibility of alignment. Fig. 3 shows the complete generator set installed, and fig. 4 shows its layout. The set is mounted on an existing flat and occupies, very appropriately, a portion of the space previously taken up by the fuel it now saves.

As will be seen from figs. 5 to 7, the electric motor, which is rated at 1,300 h.p. at 83 r.p.m., is built into the line of propeller shafting, and is located well aft in the vessel. Ventilation of the motor is arranged on the closed-circuit system, the air being circulated continuously through a water cooler and back to the machine; air trunks through accommodation spaces are thus rendered unnecessary. The commutator is not included, however, in the closed circuit, thus permitting regular inspection without dismantling. The motor is fitted with an alarm device, which gives warning in the engine room of any inadmissible rise of temperature. The motor bearings are of the disk-lubricated type, and are thus automatically supplied with an abundance of oil independently of the rolling and pitching of the vessel. Fig. 8 shows the motor assembled on the test bed at the makers' works; it has an exceedingly stiff armature and stub shaft construction.

Fig. 9 shows the control cubicle. In the centre is the single handle which starts and stops the auxiliary propelling machinery. To its right and left are the regulator hand-wheels for adjusting the operation of the plant to suit the required running conditions. The upper portion of the cubicle contains the indicating instruments and gauges.

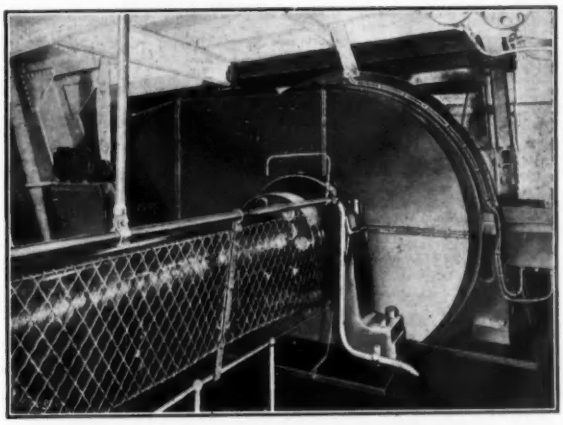
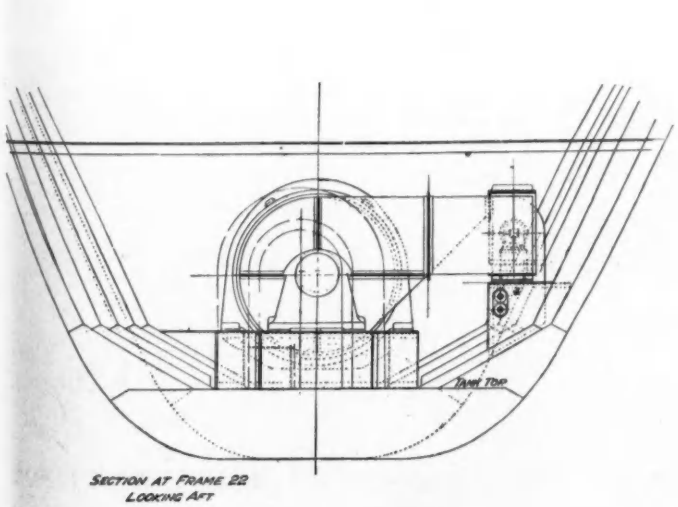
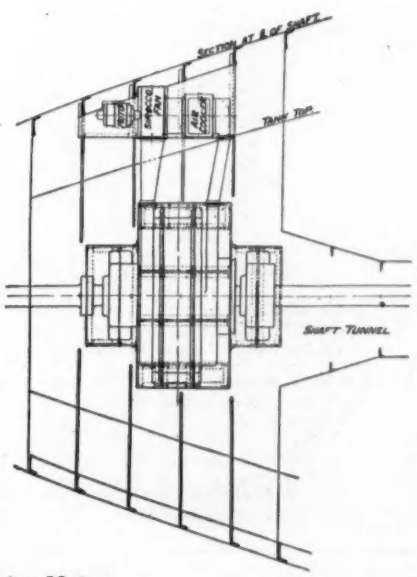


Fig. 5.—Propulsion Motor Installed.

Operation.—Once in commission, the turbo-electrical equipment functions automatically, and is reversed with the engine without separate control.

The control of the plant is obtained with the aid of an oil-relay system fed by an oil pump driven off the turbine shaft, or, at starting, by a separately-driven oil pump (see fig. 1). The operation of all the valves and safety features included in the system is such that so long as pressure is maintained in the oil-relay system the requisite steam valves and electrical switches will remain closed and the turbo-electrical equipment in commission. Failure of oil pressure immediately causes the relay-operated steam valves to isolate the turbine from the exhaust-steam supply, and to connect the exhaust direct to the condenser; by the same operation the electrical machinery is also switched out of commission. A single control valve (manually operated) in the oil-relay system is thus all that is required to put the auxiliary





Figs. 6 and 7.—Arrangement of the Propulsion Motor.

propelling machinery into and out of commission . The emergency tripping devices operate by releasing the oil pressure in the same system.

The lubrication of the turbo-generator is provided by a separate oil pump on the same shaft as the relay oil pump. The separately-driven oil pump provided to build up the oil pressure required to start the turbo-electrical equipment and to flood the bearings is shut down after the equipment has attained its normal working speed.

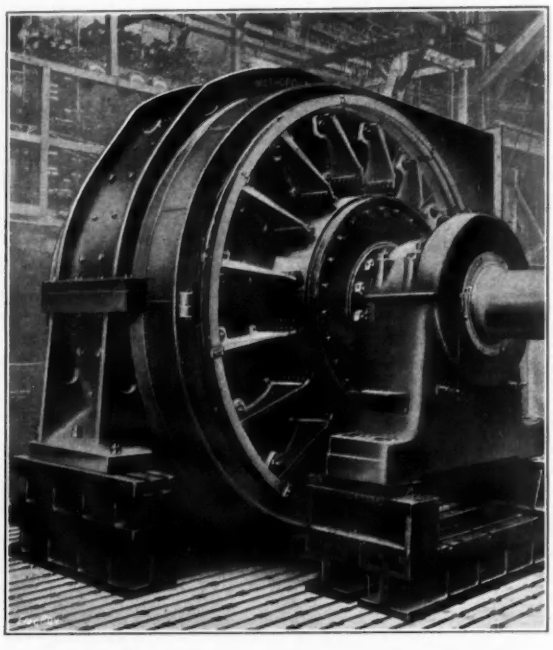


Fig. 8.—Propulsion Motor on Test Bed.

TABLE I.—Trials in Belfast Lough.

Exhaust turbo-electric installation.	In	Out
Steam pressure at boiler, lb./sq. in. g.	221.6	220.0
" " " h.p. receiver lb./sq. in. g.	212.9	211.7
" " " engine exhaust, lb./sq. in. abs.	7.915	3.70
" " " turbine inlet, lb./sq. in. abs.	7.19	—
Vacuum at turbine exhaust. Hg. (Bar. 30")	28.591	—
" " condenser inlet " " "	28.715	27.0
Steam temperature at h.p. receiver, deg. F.	565.4	558 3
Condensate temperature at condenser outlet, deg. F.	83.9	—
Condensate temperature at air pump discharge, deg. F.	98.8	94
Feed temperature to boilers, deg. F. ...	210.5	193 5
Sea temperature, deg. F.	54 5	54 5
Circulating water discharge temperature, deg. F.	76.9	85
Steam pressure at augmenter, lb./sq. in. g.	150.1	not in use
Circulating water pumps speed, r.p.m.	291	285 5
Relay oil pressure, lb./sq. in. g.	83.2	—
Bearing oil pressure, lb./sq. in. g.	15.7	—
Oil temperature entering cooler, deg. F.	115	—
" " leaving " "	100.5	—
Propeller speed r.p.m.	84.5	75.2
Power developed by reciprocating engine, i.h.p.	3,385	3,190
Motor voltage, ...	420	—
Motor amperage, ...	2,550	—
Motor output, s.h.p.	1,330	—
" " equivalent i.h.p.	1,495	—
Total power developed, equivalent i.h.p.	4,880	3,190
Condensate, lb./hour	44,300	38,650
Actual steam consumption of engines, lb./i.h.p. hour	9.085	12.12
Correction to engine steam consumption for high back pressure of 3.70 lb./sq. in. abs. instead of 25.0" Hg. vac. at engine exhaust, due to separator now placed between engine and condenser (from tests before conversion)	2.5%	
Corrected steam consumption of engines, lb./i.h.p. hour	9.085	11.82
Decrease in steam consumption due to exhaust turbo-electric system	23.0%	

Trial Data.—Sea trials were carried out on October 11th and 12th in Belfast Lough and the Irish Sea.

(*a*) *Consumption.*—A trial of one hour and forty minutes' duration was made with the engine and exhaust turbo-electric system, developing a combined power of approximately 4,900 equivalent i.h.p. A second trial of an hour's duration was then run with the engine alone working, all other conditions being kept the same as in the first trial. The results are outlined in the accompanying table, which shows that the steam consumption per equivalent i.h p. hour was 23 per cent. less with the exhaust turbo-electric system in service than with the reciprocating engine alone. In arriving at this result the steam consumption of the "engine only" trial has been corrected for the effect of the lower vacuum at exhaust caused by the interposition of the separator and by-pass valve between the engine and the condenser. The correction was obtained from trials taken at varying vacua on the vessel before conversion to the exhaust turbo-electric system.

(*b*) *Endurance.*—Full speed was maintained for a period of 12 hours, and the plant continued to operate to the entire satisfaction of all concerned. At the end of the trial the speed was reduced to about 75 per cent. of the maximum. The output of the auxiliary propulsion machinery was well maintained. At full speed the proportion of total power developed by the motor was 27½ per cent.; at 75 per cent. speed the proportion was reduced to about 20 per cent. only.

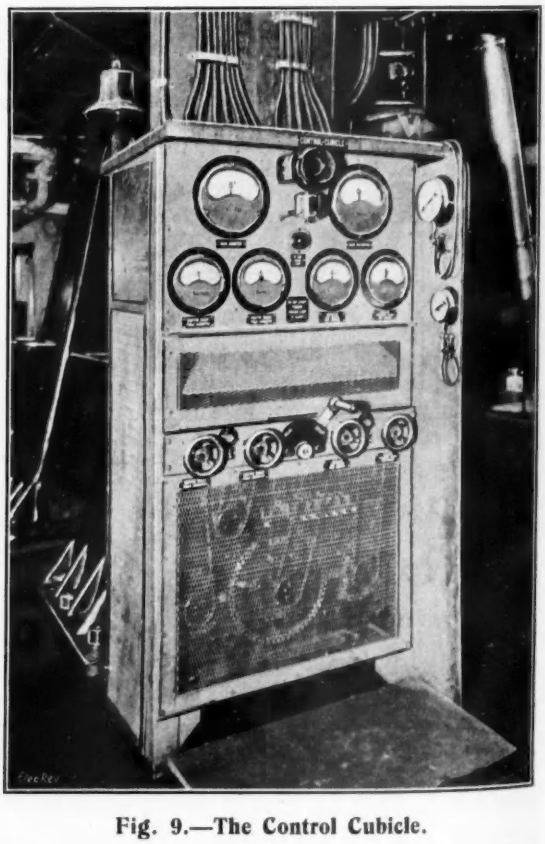


Fig. 9.—The Control Cubicle.

(*c*) *Reversing.*—A number of reversals was carried out when the vessel was steaming at about 80 per cent. of full speed. The auxiliary propelling machinery was reversed with the engine and attained full power astern in approximately 10 seconds from shutting off steam in the ahead direction.

(*d*) *Steadying Effect of Auxiliary Propelling Machinery.*—On the night of October 10th the vessel was taken into rough weather off the Irish coast. She was steaming

under light draught and the propeller was consequently partly out of the water. The load on the electrical machinery forming the coupling between the turbine and engine varied from 20 to 100 per cent. of full load. Full propeller revolutions were maintained and propeller speed fluctuation was barely noticeable. The variation of load observed indicated the extent to which the steadying effect of the turbine was being used. The above load cycle on the electrical machines is equivalent to a steady load of 63½ per cent. of full load; therefore there was a large reserve in hand for dealing with considerably worse weather conditions.

(*c*) *Reduced Speed.*—Reference has been made above to the importance of the independence of turbine and engine speeds, particularly at reduced propeller speeds. Opportunity was taken at a later trial to run the vessel at a reduced speed with the turbine running at correspondingly reduced revolutions and also at its maximum revolutions. The reduced propeller speed chosen was about 60 r.p.m. The natural turbine speed was 2,080 r.p.m., and the power developed by the motor was 345 s.h.p. The speed ratio of the electrical coupling was then altered until the turbine speed rose to 2,850 r.p.m., the reciprocating engine operating as before at about 60 r.p.m. Under those conditions the output of the motor rose to 368 s.h.p., which increase in motor output was due solely to the better performance of the turbine at the higher speed and was equivalent to an increase in total power of 2 per cent. above that obtainable with a coupling having a fixed speed ratio. The fuel consumption was, of course, the same for both running conditions. It will be noted that the flywheel effect of the turbine available for propeller speed steadying was increased 87 per cent. by the change in turbine speed.

Voyage Results.—The results of the first voyage with the new equipment indicate that important and very satisfactory improvement in over-all economy has been obtained. The vessel left Liverpool on November 1st last and reached Bombay, India, on November 24th and Karachi on December 9th. She returned thence direct to the United Kingdom, arriving in the Manchester Ship Canal on January 17th. During the whole of the voyage the auxiliary turbo-electric propelling machinery was in continuous operation and throughout worked without the slightest hitch of any description. The satisfactory results obtained may be gauged from the following figures, although a proportion of the improvement must be attributed to structural modification of the stern frame.

Using the Admiralty coal coefficient as a basis of comparison, the (winter) voyage showed a gain of no less than 35 per cent. over the mean coefficient for the six previous voyages. If, however, a comparison be made with the best previous round voyage to India, the last voyage shows a gain of 20 per cent. on the coal coefficient. The mean speed for the six previous voyages was 11.63 knots, the average coal consumption per day being 70 tons for all purposes, while for the last voyage the speed averaged 12.26 knots with coal consumption of 59 tons per day for all purposes.

The vessel encountered at times very unfavourable weather, with considerable periods of heavy pitching. When the pitching was at its worst the main current from the turbo-generator commenced to vary from 2,000 to nearly zero amperes, but, by adjusting the electrical fields, it was possible practically to damp out the fluctuation, which had the effect of reducing the propeller racing, so that the revolutions of the propeller shaft became practically constant, clearly illustrating the effectiveness of the new equipment in eliminating racing at a moderately light draught. During that time and while the main reciprocating engines were working at a reduced speed, it was also possible to operate the turbine at its full designed speed and, as racing was practically eliminated, a marked improvement in the vessel's performance resulted, both in increased speed and in increased passenger comfort, due to the steady speed of the propeller.

Rolling Mill Electrical Equipment.

Some particulars of new and old apparatus at the Newport works of the Whitehead Iron and Steel Co.

An interesting contract recently received by the Metropolitan-Vickers Electrical Co., Ltd., is one for the electrical equipment of a large new rolling mill which the Whitehead Iron and Steel Co. is putting down at its Newport works. Mr. L. D. Whitehead, managing director of the Whitehead Co., recently stated that the new mill will be the biggest producing unit of its description in the world, and added that all the equipment would be made in this country. The electrical equipment ordered includes six rolling-mill drives, one of 1,500 h.p. and five of 700 h.p., together with two 1,500-kW rotary convertors which will give a supply of direct current for operating the mill motors. The contract also includes the transformers for the rotary convertors and the necessary high- and low-pressure switchgear.

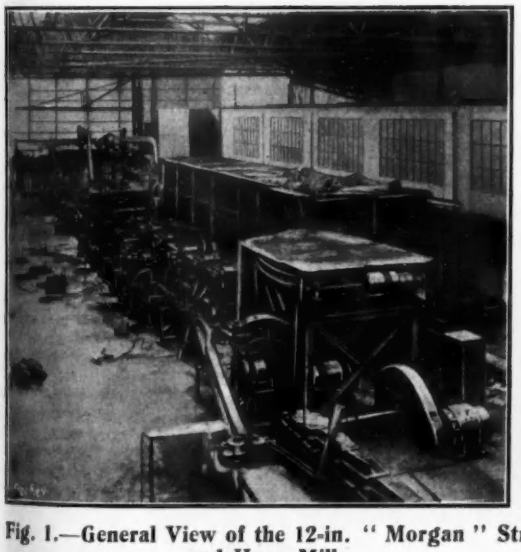


Fig. 1.—General View of the 12-in. " Morgan " Strip and Hoop Mill.

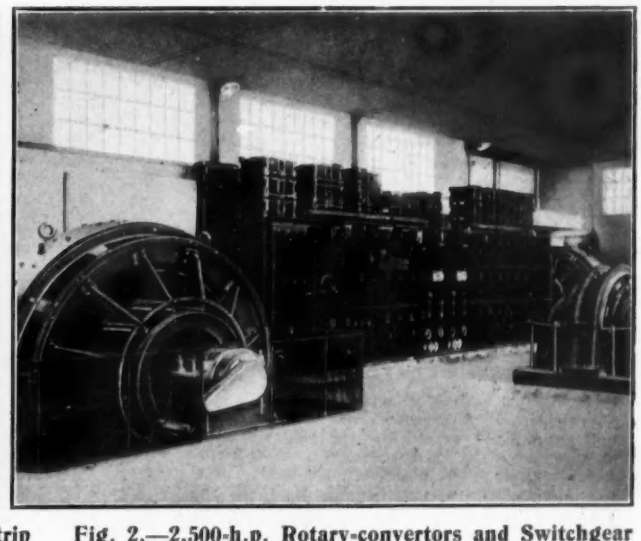


Fig. 2.—2,500-h.p. Rotary-convertors and Switchgear for " Morgan " Mill.

The new mill, which is being built by Messrs. Davy Bros., Ltd., is described as a 14-in. to 12-in. semi-continuous merchant mill of the Morgan type, and it is laid out for the production of a large variety of semi-finished and finished products, including sheet bar, general merchant sections and rods down to No. 2 guage. One of the 700-h.p. drives is for a roughing mill, the 1,500-h.p. drive is for intermediate mills, and the other four 700-h.p. drives are for finishing stands. The control of the motors will be centralised at a control desk, so placed that it commands a full view of the whole mill.

The existing plant at the Newport works, which were constructed and equipped in 1922, includes as one of the principal items a 12-in. " Morgan " strip and hoop mill which was, it is claimed, the first of its type to be built in the world. This

mill combines the features of the "Acme" mill and the "Morgan" continuous skelp mill. It comprises a seven-stand roughing mill driven by a 1,500-h.p. motor, an edging mill driven by a 100-h.p. motor, and a six-stand mill driven by a 2,500-h.p. motor, from which the finished strip is fed out at a rate of from 1,500 to 2,500 feet per minute. Fig. 1 shows the general arrangement of this mill, and fig. 2 shows the 2,500-h.p. motor, rotary convertors, and switchgear. In 1926 an extension was made to the roughing mill of the hoop and strip plant in order to enable rods to be rolled, the addition comprising five stands of rolls, three stands driven by a 200-h.p. motor and two by a 300-h.p. motor. The whole of the electrical equipment of the above plant, together with that of the cold rolling mills and practically all the auxiliary equipment, has also been supplied by the Metropolitan-Vickers Company.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Installations by the Irish Electricity Board.

In a recent letter to the *Irish Times* Mr. A. G. Bruty raised objections to the manner in which the Irish Free State Electricity Supply Board is carrying out electrical installation work. He maintains that no check on costs is made by the Board, which is unable to state whether the work is being carried out at a profit or a loss. Mr. Bruty says:—"I cannot help thinking that, had the costs been allocated to each installation as the work proceeded, there would have been a drastic revision of the absurdly low quotations that have scandalised responsible electrical installation contractors, and have forced them to the conclusion that the policy of the Board has been, and still is, to squeeze out the private trader. Now that the report and balance sheet have been produced, installation engineers whose livelihood has been so unreasonably attacked, and who, incidentally, are taxpayers, demand that a searching inquiry be instituted into the accounting system of the sales, contract, and wiring department of the Electricity Supply Board. It ought to be insisted upon that the cost of materials, labour, establishment charges, depreciation, advertisements, &c., should be shown against the selling prices and the profit or loss established."

A Report upon Hungary.

The Department of Overseas Trade has issued (through the Stationery Office, 1s. 6d. net) a report on economic conditions in Hungary by Mr. E. H. Mulock, Commercial Secretary, Budapest. Dealing with electricity supply the report says that many of the existing power stations are small and uneconomic and the demand for industrial power in the manufacturing areas round Budapest and Györ has at times exceeded the supply. The opening of the new Transdanubian Power Station early in 1930 with a capacity of 75,000 kVA, constructed with British capital by a British firm and now nearing completion, will undoubtedly relieve the situation and give a new impetus to industries in those districts, *viz.*, Budapest and Györ, which it will supply. The power from this station will also be used for the electrification of the Vienna main railway line from Budapest to the frontier at Hegyeshalom, and for electric lighting in Budapest and its suburbs. The coal to be used is a low-grade material found on the site of the power station, and its use will enable much of the industrial coal consumption (totalling 4.4 million tons, of which 1.1 million is used in public power stations) to be saved for other purposes or for export. A table in the report shows that in 1928 there were 259 public electric power plants in Hungary, employing 7,157 workers. An appendix shows that in the first nine months of 1929 Hungary's imports of electrical machinery and apparatus had a value of 18,713,000 pengö (£670,000) as compared with 12,939,000 pengö £460,000) in the corresponding period of 1928. At the same time exports of this class rose in value from 13,080,000 pengö (£467,000) to 15,882,000 pengö (£567,000).

Most of the international telegraph correspondence with Hungary is now transacted by wireless, and for this purpose a number of new stations have been established. The installation of automatic telephones is proceeding apace. At the end of 1928 there were 48,000 automatic line connections. In connection with the expansion of the national telephone system 176 new exchanges were established in 1928. The number of wireless licences issued during 1928 was double that of 1927, reaching 168,553 at the end of the year, of which 105,430 were for crystal sets and 56,332 for valve sets. The total increased to 257,500 by November 30th, 1929. The local telephone and wireless industry is important and is able to supply all ordinary requirements. There is a limited market for imported wireless kits of modern design and for the better grades of loud-speakers.

Electrical Manufacturing in Russia.

Such progress has been made in the utilisation at Soviet works of American and European experience that some of the large Leningrad works are now able to manufacture equipment for the Svir and other large power stations. Previously the Leningrad works did not produce generators of more than 24,000-kW capacity, but this year they are turning out generators of from 44,000 to 75,000-kW capacity. The Electroapparat works is organising for the first time in the U.S.S.R. the production of plant for 100,000-V working pressure for the Dubrovsk power station, for 154,000 V for the Dnieprostroi, and for 229,000 V for the Svirstroi.—*Reuter's Trade Service* (Leningrad).

Unemployment.

There was a decrease of 1,073 in the number of registered unemployed during the week ended April 7th, at which date the total was 1,676,400, as compared with 1,677,473 on March 31st, and 1,178,067 on April 8th, 1929.

Battery Manufacture in India.

Having installed plant for their manufacture in the Dependency, the Ever-Ready (India) Co., Ltd., of Calcutta has ceased to import dry batteries into India.

A "Rationalisation" Company.

In the House of Commons last week Mr. J. H. Thomas, Lord Privy Seal, announced the formation of the Bankers' Industrial Development Co., Ltd., with a capital of £6,000,000. The object of the company is to consider schemes submitted by the basic industries for the purpose of their rationalisation by industries or regions, and to arrange the necessary finance for approved schemes. The board is composed of six prominent financiers with Mr. Montagu Norman, Governor of the Bank of England, as chairman, and it will be assisted by an advisory committee. Mr. Thomas said that it was not intended that the company should consult him with a view to the guaranteeing of loans by the State.

Ideal Home Exhibition Luncheon.

A luncheon was given at the Clarendon Restaurant, Hammersmith, on April 15th, by the Household Appliances Section of the London Chamber of Commerce to Mr. F. E. Gordon, organising manager of the Ideal Home Exhibition. In proposing the toast of the "Ideal Home Exhibition," coupled with the name of Mr. Gordon, Mrs. Phyllis Lee remarked upon the rapidity with which the exhibition had been prepared and the multiplicity of domestic labour-saving appliances to be seen at this year's exhibition. Mr. Gordon, in responding, said that although they had experienced no difficulty in disposing of the added space provided by the new Empire Hall, they had wondered, at first, whether they would be able to attract a sufficient number of visitors to satisfy the exhibitors. The attendance so far, however, was over 624,000, an increase of approximately 61,000 as compared with last year. Mr. G. E. W. Crowe, in responding to the toast of the Household Appliances Section, said that some subscribers of the Trade Press were complaining that the organisation of local exhibitions were destroying the retail business. This was not so, and it had been proved that in districts where exhibitions of domestic appliances had been held, the sales of the local traders were considerably higher than in districts where there had been no exhibition. Mr. E. Herbert proposed "The Guests," and Sir Arbuthnot Lane and Mr. Raymond McGrath responded.

Trade with Russia.

The opening of the British Section of the All-Union Western Chamber of Commerce in Moscow took place on April 14th in the presence of Sir Esmond Ovey, the British Ambassador. *Reuter* reports that M. Litvinoff, Acting Commissar for Foreign Affairs, said that experience had shown that commercial relations could not develop in the absence of an agreement between two parties in the form of a commercial treaty. In the economic relations of the Soviet Union with foreign states, owing to the difference in the governmental and economic systems in existence, such a treaty was particularly necessary. It should afford deep satisfaction that an agreement between the U.S.S.R. and England would soon be reached in the form of a commercial treaty. That agreement would create a feeling of complete safety and assurance without which it was impossible to embark far on the sea of commerce.

The Anglo-Russian commercial treaty was signed in London last week. The Moscow correspondent of the *Observer* reported on Saturday last that M. Saul G. Bron, the Soviet trade representative in England, had stated that orders had been placed with the "Imperial Chemical Trust" to a total value of £3,000,000. In addition an agreement involving purchases of about £2,000,000 had been concluded with the Metropolitan-Vickers Company, and tractors had been ordered from the Armstrong-Vickers Co. "M. Bron has declared that the Soviet Union will place orders of a minimum value of £20,000,000 in England in the current year, while during the last months the number of British ships which the Soviet authorities have chartered is trebled as compared with the preceding year."

German Foreign Electrical Trade.

The imports of electrical machinery and apparatus into Germany during January last attained a value of £190,850, as compared with £229,300 in the corresponding month of last year. There was also a decline in the exports of similar material from Germany—from £2,518,850 to £2,449,750.

Swedish Electrical Exports and Imports.

The exports of electrical machinery from Sweden during the first two months of this year attained a value of £433,700, as compared with £330,935 in the corresponding period of 1929. There was also an increase in the imports of electrical machinery into Sweden—from £119,340 to £223,755.

The Buenos Aires Tube Scheme.

The *Financial Times* reports that negotiations have been concluded for the issue by Harris Forbes & Co. of $12,000,000 (£2,400,000) three-year notes of the South American Railways Company, a concern recently organised as a medium for co-operation between Argentine, British and American interests operating railways in South America. The proceeds of the issue, together with the capital raised by a recent offering of $2,500,000 (£500,000) preferred stock, will be used to acquire the whole of an issue of $14,500,000 (£2,900,000) 8 per cent. three-year notes of the Buenos Aires Central Railroad and Terminal Company, which is being made to finance the new underground railway now under construction in that city. The South American Railways Company will also acquire an option on approximately half the ordinary share capital of the Buenos Aires concern. British, American, and Argentine interests are represented on the board of the South American Railways Company, which will include directors of the Harris Forbes banking group; Mr. Roger Wright, of the Foreign Railways Trust; Mr. O. H. C. Balfour, of Harris Forbes & Co., London; and Dr. T. Lacroze, representing the important Argentine interests of Lacroze Brothers, and president of the Buenos Aires Central Railroad and Terminal Company.

French International Radio Exhibition.

The French Syndicat Professionel des Industries Radio-Electriques at a recent meeting decided to organise a wireless exhibition in Paris at the end of September next. On this occasion the Show is to be international in character, the only reservation being that only firms in those countries which do not admit French manufacturers to their exhibitions will be excluded from the French Show.

A New Aid to Radio Dealers.

With the object of assisting radio dealers to deal with problems which they are likely to meet in connection with service, before and after sale, the Marconiphone Co., Ltd., has arranged for Capt. P. P. Eckersley to write a series of articles covering the whole question of service from the dealer's point of view. The first two of these articles have been published, part one, being of an introductory nature, dealing with the question generally, the second containing hints on the successful demonstration of radio receivers. With the first article a strong cardboard binder is issued to enable dealers to file the articles, which will be published monthly, for future reference.

Unpaid Feathered Workers.

A little booklet has been published by the Carron Company entitled "Nature Allied to Industry," in which the means adopted by the company to keep the under-water weeds of its reservoirs in check are described. These reservoirs cover an area of 40 acres, and by the preservation of natural growth on the banks have the appearance of a natural lake. The water from this lake is used for cooling the blast furnace tuyeres, &c., and water fowl of all kinds have found sanctuary there. It was decided that swans should perform the work of under-water scavenging, and the number has gradually increased until there are now 100 of them. The story of these unpaid feathered workers makes interesting reading.

A Chinese Contract.

The Chekiang Electricity Bureau, which is closely associated with the Chinese National Construction Commission, has recently placed contracts for one of the largest and most up-to-date electric power station equipments yet ordered for China. The station will be built on a specially selected site on the banks of the Chien Tang River. The contract for the electrical plant has been secured by Inniss & Riddle (China), Ltd., and is for two B.T.-H. 7,500-kW, 14,000-V turbo-alternators. The steam conditions are: Pressure 350 lb. per sq. in. and temperature 720 deg. F. Low pressure steam will be drawn from two stages of the turbines for feed-water heating and evaporating purposes. The boiler plant, the order for which has been placed in the United States, will consist of two units, each capable of producing 75,000 lb. of steam per hour, pulverised coal being used as fuel.

The Radio Wholesalers' Federation.

The second annual meeting of the Radio Wholesalers' Federation was held on April 9th, at the Connaught Rooms, W.C.2. The chairman (Mr. E. W. Houghton) presided, and in proposing the adoption of the report, referred to the printed list of wholesalers which the Federation had issued during the year. This, he said, although not carrying the sanction of the radio manufacturers in their corporate capacity, had fulfilled a useful and definite purpose, as many manufacturers had found it of service in arranging their trading policies. Conferences with the B.R.V.M.A., had resulted in the establishment of good understandings upon several important points of mutual interest and value. The chairman welcomed the steps being taken by the R.M.A. to establish a system for the rigid maintenance of the retail prices of proprietary radio goods. With regard to wholesale price-cutting, the R.W.F. had had prepared a form of undertaking for manufacturers to have signed on their own behalf when entering into business relations with wholesalers. This had been adopted by a number of manufacturers wholly, or with modifications to suit their own conditions. The adoption of the report was seconded by Mr. Beadle (T. Beadle & Co., Ltd.) The retiring members of the Council were re-elected, and a vote of thanks to the chairman was accorded on the proposition of Mr. A. G. Beaver (Sun Electrical Co., Ltd.).

For Sale.

The Electricity Distribution of North Wales and District, Ltd., has for sale one Crompton d.c. 70-h.p. motor-generator, one Dorman-E.C.C. 4-cylinder petrol engine, and 25-kW d.c. generator, two Higgs 11-kW d.c. generators, motors, meters, switchboard, &c.

The Edinburgh Corporation Electricity Supply Department has for disposal d.c. turbo-generator sets, water-tube boilers and other plant.

Aylesbury Corporation has for sale a suction gas producer, 4-cylinder Premier gas engine, coupled direct with 200-kW, 440-V, G.E.C. generator, complete with accessories. (See our advertisement pages to-day.)

Local Exhibitions.

Egremont (Cumberland).—At the "Empire" recently, the Cumberland Waste Heat Owners' Co., Ltd., arranged a display and demonstration of electric cooking, heating, and labour-saving appliances. The exhibition was a prelude to the commencement of a supply in a number of places in the area.

Louth (Lincs.).—At a recent meeting of the Town Council a proposal by Councillor Beckett, the chairman of the Electricity Committee, that an electrical exhibition should be held from May 5th to 19th was approved. The exhibition will coincide with the inauguration of the electricity scheme, and electrical contractors have agreed to contribute to the cost of the display.

Social Events.

We discovered further amateur dramatic talent on Wednesday last week when we attended the first public performance of the Dramatic and Musical Section of the Callender Athletic and Social Club. The piece chosen was "Grumpy," a four-act play by Horace Hodges and T. Wigney Percyval. The part of Mr. Andrew Bullivant, the eponymous central figure, was taken by Mr. S. W. Graefe, who sustained the character of an eccentric retired criminal lawyer very ably—a by no means easy task. His cherished grand-daughter Virginia was delightfully represented by Miss G. Ivimy, and Mr. A. A. Beckingsdale as Ernest Heron (Virginia's *fiancé*), played his part admirably. As a "swell crook" (Jarvis), Mr. W. A. Dickson gave a very polished performance, which few professional actors could have bettered. Light relief was afforded very frequently by Mr. Bullivant's "man" Ruddock (Mr. P. Loosemore), who was really most amusing. If all maids were like Miss D. A. Clark (Susan) there would be no servant problem. Mr. H. W. Fletcher as the sprightly Valentine Wolfe was very good. The rest of the cast, who all added to the success of the show, were: Mr. J. E. Dunsford (Dr. Maclaren), Miss G. B. Archer (Mrs. Maclaren), Mr. E. H. Dyson (Keble), Mr. L. H. Wratten (Merridew), and Mr. A. C. Clitherow (Dawson). Miss E.

Goole was the producer, Mr. E. A. Bridge hon. publicity and business manager, Mr. L. G. Baber was in charge of the box office, and Mr. L. H. Wratten looked after the properties. The hon. secretary of the Section is Mr. W. A. Dickson. Before the play and in the intervals the orchestra, under the direction of Miss E. Glenn, proved that musically, as well as dramatically, the Section is in a strong position. At the fall of the curtain Mr. Howard Foulds, secretary of Callender's and founder of the Section, made presentations to the lady members of the cast and to Miss Goole, to whom he paid a special tribute. Among the audience we noticed Messrs. P. V. Hunter, C. Pipkin, and T. Petersen (joint managers of Callender's), and Mr. W. G. Hendrey (overseas manager).

The final tie of the London Business Houses Amateur Sports Association (Football), for the Buchanan Cup, took place on Saturday, the 12th inst., between Johnson & Phillips, Ltd., and Centels (Central Telegraph G.P.O.) on the sports ground of Messrs. Van Den Berghs, Ltd., at Wimbledon Park. The game was followed by a large crowd, and the pace set by both teams in the early stages was sufficient to keep the result uncertain, but the J. & P. team emerged winners by three goals to nil. After the game the Buchanan Cup was presented by Major Cokey, M.C., of Messrs. Van Den Berghs, Ltd., to the J. & P. captain. The referee for the match was Mr. W. Curtis, of the Union Cable Co., and his handling of the game was admirable.

An Indian Theatre Installation.

The accompanying illustration is typical as affording another indication of the advance of Western civilisation and methods in India. It is a view from behind the scenes of the new

The New Empire Theatre, Calcutta.

Empire Theatre, Calcutta, showing the stage-lighting switchboard, battens, and the auditorium. The major part of the electrical equipment was supplied by the General Electric Co. (India), Ltd., of Calcutta.

Bankruptcy Proceedings.

E. J. Melville, lately trading as James Melville & Co., Angel Row, Nottingham, electrical contractor.—The first meeting of creditors was held on April 15th. According to the statement of affairs there were gross liabilities amounting to £1,652, of which £1,577 was expected to rank, and there was a deficiency of £1,525. Debtor attributed his failure to lack of capital, heavy extraneous trade expenses, and bad debts. Debtor commenced business in 1920 as a retailer of electrical goods. In May, 1929, he took into his employ a man who introduced £200 as capital into the business. He agreed to work at a salary of £3 per week and receive a percentage of the profits. It was also arranged that he should become a partner later. The business continued to be unsuccessful, and in February last the other man left him. On February 26th last a meeting of creditors was held at which the debtor offered 4s. in the £. This, however, was not accepted, and a creditor presented a petition upon which the receiving order was made. The matter was left in the hands of the Official Receiver, 22, Regent Street, Park Row, Nottingham, as trustee.

Don Gabriel de Yrarrazaval, company director, Grosvenor House, Park Lane, W.—The statutory first meetings of creditors were held last week at the London Bankruptcy Court. The debtor, who has not yet attended under the proceedings, was director of Andia, Ltd., and Artandia, Ltd. He is stated to be a wireless inventor. The companies sold radio apparatus and they are now both in liquidation. Mr. Waterer, Deputy Official Receiver, dealt with proofs of debt for £17,789, including £15,000 claimed by the Earl of Dysart, and £1,250 by the petitioning creditors. Mr. Aubrey Pollock stated that he acted for the Marquis de Andia Yrarrazaval until 18 months ago, and in addition to being a creditor for costs he represented a creditor who would lodge a proof of debt for £13,000. A resolution was passed for Mr. F. S. Salaman, 2, Bucklersbury, E.C., to act as trustee and administrator of the estate in bankruptcy.

J. H. Dean, electrician, late of 4, Gogeiddan Place, Aberystwyth.—Last day for proofs for dividend, April 29th. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

E. Doudney, wireless wholesale and retail salesman, 43, East Street, and 40, South Street, Chichester.—Receiving order made April 11th on debtor's own petition.

A. C. Dobbing and A. L. Rothery (Ripon Electrical Co.), electrical engineers, 39, Kirkgate, Ripon.—Receiving order made April 10th on debtors' own petition. First meeting, May 2nd, at the County Court Office, Harrogate. Public examination, May 9th, at the Court House, Harrogate.

L. E. Hember, electrical engineer, 4, Pepper Street, Lymm, Chester.—Receiving order made April 11th on debtor's own petition. First meeting April 25th, at the Official Receiver's Offices, Government Buildings, Victoria Street, Liverpool. Public examination, June 6th, at the Court House, Warrington.

C. Shepherd, radio engineer and dealer in wireless accessories, 69, Micklegate, York.—Receiving order made April 10th on debtor's own petition. First meeting, May 1st, at the Official Receiver's Offices, Duncombe Place, York. Public examination, May 15th, at the Law Courts, York.

W. H. Thornton, electrical and wireless engineer, 25, Bridge Street, Burnley.—Last day for proofs for dividend, May 6th. Trustee, Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn.

Company Liquidations.

Celebritone, Ltd., 72, Oxford Street, W., gramophone and radio manufacturers.—Mr. C. Latham, of the Wireless and Allied Trades Association, and Mr. E. F. Wilkins, who have been appointed the joint liquidators in this matter, have issued a circular to the creditors, stating that on February 11th the company went into voluntary liquidation, the directors having filed a declaration that to the best of their knowledge the creditors' claims would be paid in full within twelve months of the date of such declaration. The liquidators decided to carry on the business in a restricted way for a short period. On March 18th a petition to wind up the company compulsorily was presented and adjourned for fourteen days, Mr. Justice Maugham directed that a meeting of the creditors should be convened by the Official Receiver for the purpose of enabling the creditors to say whether they wished the voluntary liquidation to continue, or the company to be wound up subject to the supervision of the Court, or the company to be wound up compulsorily, and if a committee of inspection should be appointed. The estimated net assets totalled £15,146, and an estimated excess of assets over liabilities of £5,727. The liquidators urged the creditors to vote for the continuance of the voluntary winding up, but if the creditors felt they were not sufficiently protected, they asked them to vote for the voluntary winding up being continued under the supervision of the Court, with a committee of inspection. The meeting of creditors convened by the Court was held on April 10th and the result was reported to the Judge last week (*vide* our "Legal" column).

Wall's (North Wales), Ltd., electrical contractors, Prestatyn.—The statutory meeting of creditors was held on April 10th at Prestatyn. The statement of affairs showed ranking liabilities of £700 and net assets of £908, leaving a surplus of £208, so far as the creditors were concerned. It was estimated that in the event of a forced realisation there would be a deficiency as regarded the creditors of £217. The company was registered on April 10th, 1928, with a nominal capital of £1,000, all of which was issued as fully paid. The deficiency was largely attributed to loss on trading and depreciation of assets shown in the statement of affairs. The creditors confirmed the voluntary liquidation of the company with Mr. Harold Smith as liquidator, and a committee of inspection was also nominated. The following are creditors:—

	£		£
Hoover, Ltd.	31	G. J. Supplies	35
H. Smith	22	General Electric Co., Ltd.	39
Edison Swan Electric Co., Ltd.	57	Metro-Vick Supplies ...	202
		F. R. Wetton	26

Border Electrical Factoring Co., Ltd.—A meeting of creditors was called for April 24th, at 14, Lowther Street, Carlisle, for the purpose if thought fit of nominating a liquidator and appointing a committee of inspection.

Condor Lamps (Gt. Britain), Ltd.—A meeting of members is called for May 20th at the liquidator's offices, Spencer House, South Place, E.C.1, to hear an account of the winding up from the liquidator, Mr. W. H. Bevan.

Electro-Drives, Ltd.—A meeting of creditors is called for April 29th at the offices of the company, Curtis Buildings, Abbey Road, Park Royal, N.W.10.

Carrara-Versilia Electric Railway & Power Co., Ltd.—A meeting of creditors is called for May 6th at Queen's House, 28, Kingsway, W.C.

Private Arrangement.

R. A. Mitchenall (trading as Mitchenall Bros.), 187, Trafalgar Road, Greenwich, S.E.10, electrical engineer.—A meeting of creditors was held on April 11th, when it was reported that the liabilities amounted to £431 and the net assets to £95, leaving a deficiency of £336. It was reported that the debtor had been doing repair work during the last eighteen months as shop sales had fallen off. It was suggested that certain creditors should restock the shop with their own goods and carry on the business with a view to eventually selling it as a going concern. It was stated that any profits that might be made would be handed over to the trustee under a deed of assignment for distribution amongst the creditors. The suggestion was left in the hands of a committee of inspection, and a resolution was also passed in favour of a deed of assignment being executed to Mr. Walter Porter as trustee. The following are creditors:—

	£		£
Bankers	147	Clark & Moire	33
Burner Insulator Co. ...	55	Calmont, King & Co. ...	21
Lenham Accumulator Service	50	Siemens Electric Lamps and Supplies, Ltd. ...	20

Winding-Up Petition.

Mayfair Electric Gramophones, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. Buck & Hickman, Ltd., 2-6, Whitechapel Road, E., creditors, and will be heard in London on May 5th.

Deed of Assignment.

H. D. Fry (Ashton Electric Co. and the Ashton Service Co.), 5, Spring Bank, Kingston-upon-Hull.—Particulars of claims by May 7th to the trustee, Mr. S. G. Oxley, Commercial Chambers, Commercial Road, Hull.

Application for Patent Extension.

Western Electric Co., Ltd.—A petition has been presented to the High Court for the extension of Patent No. 141,047 of May, 1914, on behalf of the Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) for "Improvements relating to Signalling by High-Frequency Currents as in Wireless," for a further term of five years, and will come before Mr. Justice Luxmoore for hearing shortly.

New Catalogues and Lists.

Carrington Manufacturing Co., Ltd., Camco Works, Sanderstead Road, South Croydon.—Two leaflets advertising "Camco" cabinets for radio receivers.

Electrical Equipment & Carbon Co., Ltd., 107/111, New Oxford Street, W.C.1.—Pamphlet No. K.P.4 giving details of "K.P." tongs for cable drawing. Illustrated and priced.

Automatic Coil Winder & Electrical Equipment Co., Ltd., Winder House, Douglas Street, S.W.1.—Three leaflets illustrating "Douglas" automatic coil winders, with paper insertion attachment.

Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, Oxford Street, W.1.—A well-produced and illustrated brochure describing the "Hotpoint-Maytag" electric clothes washing, wringing, and ironing machine. Also Catalogue No. 280 of the company's electric cookers. Illustrated.

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—Illustrated list No. 108 describing Cambridge instruments for hydrogen-ion measurements.

Verityx, Ltd., Aston, Birmingham.—Publication No. 1086/30 drawing attention to "Maxlume" explosion-proof fittings.

Lea Recorder Co., Ltd., 28, Deansgate, Manchester.—Publications Nos. C.B.M. 13 and 15, giving illustrated and descriptive particulars of the Lea "Cubi-Meters" for measuring coal, and other materials, in bulk.

General Chemical & Pharmaceutical Co., Ltd., Willesden, N.W.10.—An abridged price list of "Judex" analytical reagents and laboratory chemicals.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Leaflet No. 315 dealing with the company synchronous induction motor starting panel.

Messrs. John Harper & Co., Ltd., Albion Works, Willenhall, Staffs.—A postcard drawing attention to grey iron castings for electrical, general, and marine engineers.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Leaflet No. 1013 containing illustrated particulars of automatic motor starters.

Monel-Weir, Ltd., Cathcart, Glasgow.—A list of the established uses of Monel metal in the process industries with illustrations showing some of its applications.

Trade Announcements.

The whole of the clerical staff of Aeonic Radio, Ltd., has now removed to the works at Horley, Surrey, where all correspondence, &c., should be sent. An office will still be maintained at 90, Regent Street, W.1, for demonstration purposes.

From May 1st next the London office address of Messrs. J. G. Statter & Co., will be at 16, Great George Street, Westminster, S.W.1. The telephone number will remain unchanged.

The offices and works of Celestion, Ltd., have been transferred to London Road, Kingston-on-Thames. (Telephone: Kingston 5656-9.)

Book Notices.

"Electrical Wiring and Contracting," edited by H. Marryat. Vol. IV. Pp. viii+1024; figs. 61. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

"Electric and Magnet Circuits, A.C. and D.C.," by E. N. Pink. Pp. vii+124; figs. 60. London: Sir Isaac Pitman and Sons, Ltd. Price 3s. 6d. net.

"The *Journal* of the Royal Technical College of Glasgow," Vol. 2, Part 2, January, 1930.—A record of some of the research work carried out in the College by the staff and senior students. Price 10s. 6d.

"Progress in Subscribers' Transmission Apparatus." By L. C. Pocock, M.Sc. A paper presented to the World Engineering Congress, Tokyo, 1929, dealing with improvements made in recent years in subscribers' telephone apparatus. Published by the International Standard Electric Corporation.

Recent Contract.

The General Electric Co., Ltd., has received an order from the Glasgow Corporation Tramways for electrical equipments in connection with a tramcar re-building scheme. The order comprises 450 motors, 60 h.p. on the one hour rating, 600 V, together with resistances and circuit breakers.

Employment during March.

The April *Ministry of Labour Gazette* states that employment in the engineering industry continued bad on the whole during March and showed a general decline as compared with the previous month. Conditions were fair in electrical engineering. The total number of unemployed in the engineering industry at March 24th was 120,873, the proportion rising from 11.1 to 12.0 per cent. In the electrical engineering branch the number of unemployed was 5,101, raising the percentage from 5.7 to 6.0. The electric cable, wire and lamp manufacturing group reported a rise to 7,007 in the number of unemployed, raising the proportion from 6.9 to 7.5 per cent. There was also greater unemployment in the electrical wiring and contracting industry, the number being 1,521, and the proportion 9.2 per cent. against 8.5 per cent.

Prices of Materials.

Messrs. F. Smith & Co. report April 23rd:—Copper (electrolytic) bars £66, £18 6s. 3d. dec.; do. do. sheets, no change; do. do. wire rods £72 10s., £21 16s. 3d. dec.; do. do. h.c. wire 9 11/16d., 1 15/16d. dec.; silicium bronze wire 1s., 2d. dec.

Messrs. James & Shakespeare report April 23rd:—Copper bars (best selected) sheet and rod £92, £18 dec.; English pig lead £19 10s., 10s. dec.

Messrs. Edward Till & Co. report April 23rd:—No change in the price of india-rubber, Para fine.

Lighting and Power Notes.

Algeria.—Distribution Concessions.—The Société Lebon and Co. has secured the concession for the establishment of an electric power distribution system in the town and district of Laghouat. The Société Hydro-Electrique de l'Afrique du Nord, of Algiers, has also obtained a concession for the distribution of electricity in the Department of Constantine.

Bangor.—Revision of Electricity Charges.—The Corporation Electricity Committee has amended its contract tariff for the supply of electricity for domestic purposes as follows:—A fixed primary charge of: (*a*) 24s. per annum for each of the following rooms:—Kitchen, sitting room, dining room, drawing room, breakfast room, study, nursery or other living rooms; and (*b*) 8s. per annum for each bedroom. There will be no primary charge in respect of other portions of the premises except in special cases of large residences where there may be more than one scullery, pantry, &c. The "unit" charge will be at the rate of 1d. per kWh irrespective of quantity. Before the Corporation can qualify for the reduction in bulk supply terms offered by the North Wales Power Co., Ltd., it must offer domestic consumers a two-part tariff consisting of a primary charge plus a rate per kWh not exceeding 1d.

Bedford.—Assisted Wiring Scheme.—The Corporation has obtained sanction to the borrowing of £15,000 for the development of its assisted wiring scheme.

Buckie.—Gas Company Opposes Electricity Scheme.—The Buckie Gaslight Co. has lodged formal objections to the electricity scheme put forward by the Town Council, on the ground that there is not sufficient demand for electricity in the proposed area to justify the establishment of an electricity undertaking in the hands of the Town Council. The company further urges that, under the provisions of the Order, the Town Council would be enabled to supply electrical energy for cooking, lighting, heating, power, and other purposes for which the company supplies gas, and would be free to carry on its undertaking at a loss and charge the deficiency to the local rates.

The company would thus be placed in the position of having to contribute as ratepayers to the support of an undertaking competitive with its own.

Caernarvon.—Administration.—At a recent meeting of the Corporation Electricity Committee, a report was made upon the steps taken in view of the acquisition of the electricity undertaking. The manager was authorised to engage the necessary station staff and to carry on the works, and he was also instructed to prepare a scheme for a two-part tariff to be put into operation immediately. Asked whether the Corporation would undertake the wiring of houses, the Deputy-Mayor said that the committee would not undertake such contracts, but it would be done by contractors.

Canada.—Large Power Purchase.—An important power purchase in connection with the development of the mining regions of Northern Ontario is announced by the *Daily Telegraph*. Under the agreement the Ontario Hydro-Electric Power Commission will take 100,000 h.p. from the Hudson's Bay Power Co. and its subsidiary, the Abitibi Power & Paper Co. The agreement involves the immediate expenditure by the Abitibi Co. of $3,000,000 (£600,000) on a development sixty-three miles north of Cochrane on the Abitibi River, and also the construction by the Hydro-Electric Commission of a transmission line to Sudbury costing $3,500,000 (£700,000).

Continental.—Spain.—It is considered probable that the large electrification schemes of the Dictatorship will be considerably limited if not abandoned.—*Reuter's Trade Service* (Madrid).

Austria.—At the Witkowitz iron and steel works and collieries there is at present under construction under licence a battery of Loffler steam boilers for use in one of the power generating stations. The boilers are being built for a working pressure of 130 atmospheres, and to provide steam at a temperature of 500 deg. C. for a 36,000-kW three-stage steam turbine designed to run at 3,000 r.p.m. The turbine will be coupled direct to a 48,000-kVA alternator generating at 5,350 V, the machine being stated to be the largest so far constructed in Europe for a speed of 3,000 r.p.m.

Germany.—A new hydro-electric power station, with a potential output of 56,000,000 kWh per annum, has recently been completed on the River Neckar jointly by the municipal authorities of the town of Tubingen and the Herrenberg Elektrische Kraftubertragung Gesellschaft.

Dartford.—Change-over Application.—The Urban District Council Electricity Committee has decided to apply for sanction to enable the Council to change the supply to existing consumers from d.c. to a.c. as and when occasion arises.

New Sub-station.—The Electricity Committee is to erect a sub-station in Shepherds Lane, at a cost of £3,248, in connection with supplies to the Heath Close, Heath Farm, and Whitehill estates.

Ealing.—Ring Main.—The borough electrical engineer has been instructed to proceed with the preparation of specifications and estimates for the laying of a 33,000-V ring-main, and the installation of the necessary switch and control gear.

New Sub-station.—The Corporation Electricity Supply Committee has decided to erect a sub-station on a site at the rear of 50, Uxbridge Road.

Glasgow.—Progress During March.—Under the Corporation Electricity Department's scheme 947 houses were wired in March, bringing the total to 22,043, while hired appliances numbered 92, making the total 20,329.

Mains Extensions.—The Corporation Electricity Committee recommends the laying of distributing mains, at a cost of £7,574.

Hampton.—Prospect of Electricity Charge Reductions.—At a meeting of the Urban District Council held recently, a report was read on the negotiations by the London and Home Counties Joint Electricity Authority for the purchase of the Twickenham and Teddington Electricity Supply Co., Ltd. It was stated that, on the completion of the purchase, there would be a reduction almost at once in the price of electricity from 7d. to 5½d. per kWh, and it was probable that the reduction might even be greater.

Japan.—Electrical Developments.—The Agatsumagawa Electric Power Co. has recently completed a new electric power station. The company is now preparing to proceed with the second part of its plan, which includes the building of a 18,000-kW power station at Nishikubo, and one of 7,000 kW on the Agatsuma River at Imomata. The Kyushu Electric Transmission Co., Ltd., has completed a 24-mile transmission line between the Tashiro power station at present under construction on the Mimi River in Miyago Prefecture to a sub-station at Takachiho. After the completion of the Tashiro power station, the Kyushu Co. is planning to build two further hydro-electric stations, one at Yamasuhara, with a capacity of 13,000 kW, and the other of 50,000-kW capacity at Tsukahara.

London.—St. Pancras.—The Borough Council has received sanction to the borrowing of £9,160 for mains.

Shoreditch.—The Borough Council Electricity Committee recommends that application be made for sanction to the borrowing of £4,900 for feeder equipment and reactors.

Fulham.—The Borough Council Electricity and Lighting Committee recommends the erection of sub-stations at North-End House, West Kensington, and Rivermead Court, Hurlingham, at a total cost of £5,313.

Stoke Newington.—The Borough Council Electricity Committee has received sanction to the borrowing of £10,000 for mains and services.

Paisley.—Loan.—The Town Council has decided to apply for sanction to a loan of £35,647 for meters, domestic apparatus (for hire), consumers' wiring installations (for hire), extension of mains &c.

Plymouth.—Discontinuance of Free-wiring Scheme Recommended.—Having given consideration to the policy of free wiring the Corporation Electricity Committee has decided to recommend the discontinuance of the scheme, and that all persons whose orders have not yet been executed be recommended to wire their houses under the Corporation's assisted scheme. The Committee further requested the electrical engineer to submit a report regarding the existing system of supplying electricity through prepayment meters.

Price Reductions.—Reductions in the charges for electricity has been made or recommended in the following districts:—

Hawarden.—Domestic power: From 2d. to 1d. per kWh.

Carmarthen. — *Carmarthen Electric Supply Co., Ltd.*—Lighting: From 8d. to 7d. per kWh.

Dartford.—Cooking, for tea-shops, restaurants, and dining-rooms: From 1½d. to 1d. per kWh.

Lewes.—*The Lewes & District Electric Supply Co., Ltd.*—Lighting: First 75 kWh per quarter, 8d. per kWh; above 75 kWh, 7½d. Special power rate: First 20,000 kWh per annum, 2d. per kWh; above 20,000 kWh, 1½d., with a guaranteed minimum payment in respect of 20,000 kWh per annum. A discount of 5 per cent. is allowed on accounts paid within fourteen days.

Richmond (Yorks.).—Lighting: From 7d. to 6d. per kWh. Power: From 3½d. to 3d. per kWh.

Walton-upon-Thames.—Lighting: To 7d. per kWh. Power: To 3½d. per kWh for the first 100 kWh consumed per quarter.

Grange-over-Sands.—Lighting: First 250 kWh per quarter, 9d. per kWh; over 250 kWh, 7d. Prepayment meter supplies: To 10d. per kWh, including meter rent. Rateable value system: A fixed annual charge of 20 per cent. of rateable value up to £100, and 10 per cent. of rateable value beyond £100, plus 1½d. per kWh.

Lossiemouth (Morayshire).—Lighting: From 9d. to 8d. Heating: From 2d. to 1½d. Power: From 4½d. to 3½d.

Richmond (Yorks.).—Extensions.—The Corporation Electricity Committee proposes to apply for sanction to the borrowing of £1,300 for extensions.

Rochester and Chatham.—Terms for Extension of Tenure Rejected.—The Kent Electric Power Co. has placed before the Town Councils proposals in exchange for which the company asks for a 42 years' extension of tenure. The company offers to reduce the price of electricity for lighting from 6½d. to 6d. per kWh, and for power from 2d. to 1½d. per kWh, and the rent of meters up to 10 amps. from 3s. to 2s. 6d. per quarter; to introduce a two-part alternative tariff for domestic and business purposes; and to provide a hire-purchase scheme for installations, including electrical apparatus for domestic use and motors for industrial purposes. The company also offers to put in hand immediately necessary reinforcements of the system of distributing mains, and to extend the distributing cables in Rochester, Chatham and Strood. The total cost of the work scheduled is estimated at £35,000. The Joint Lighting Committee, which has had the matter under consideration, has decided that the proposals made, both as regards reductions of charges and development, are quite inadequate, and has declined to entertain them.

South-East Lancashire Electricity Advisory Board.—Special Order.—The Engineering Advisory Committee has recommended the Board to support the application of the Lancashire Electric Power Co. for a Special Order to supply electricity in the parishes of Dalton, Parbold, and part of the parish of Wrightington in the rural district of Wigan.

Bulk Supply.—The committee also recommends the Board to approve contracts for bulk supplies from the Bury Corporation to the Heywood Corporation and from the Manchester Corporation to the Middleton Corporation.

Fringe Orders.—Applications for Fringe Orders have been made by the Eccles Corporation to supply Barton Moss aerodrome and for the Cheadle and Gatley Urban District Council to supply certain premises in Northern Etchells, and the committee has recommended the Board to support the applications.

The above minutes of the Engineering Advisory Committee have been approved by the Board.

Swansea.—Mains Extensions.—The Corporation Electricity Committee is to extend mains at an estimated cost of £1,090.

Tanganyika.—Electrical Development Scheme.—An agreement has been reached between the Tanganyika Government and the Power Securities Corporation for the development of the country's water-power resources. The company is to supply electricity over an area extending from the shores of the Indian Ocean to Lakes Victoria, Nyanza and Tanganyika.

Taunton.—Power Station Extensions.—The Town Council is to apply for sanction to the borrowing of £9,500 for additional plant and boiler-room extensions at the electricity works.

United States.—A Large Water Turbine.—One of the largest hydro-electric generators ever made is to be installed this year in the generating station of the New York Power and Light Corporation at Spier Falls, on the Hudson River. It will be capable of producing 57,000 h.p.; at present the Spier Falls station has eight water-wheel generating sets, but the new machine will have a greater capacity than the eight together. Only the generators at Niagara Falls and at Conowingo, on the Susquehanna River, will be comparable with the new Spier Falls machine. Its electrical capacity of 47,000 kVA puts it second among the three, as those at Niagara are of 65,000 and those at Conowingo of 40,000 kVA. Its height, 24 ft. 2 in., puts it third, as the Niagara sets are 26 ft. 6 in. high and those at Conowingo are 33 ft. 2 in. In weight it is also third, its 994,000 lb., comparing with 1,513,000 lb. of the Niagara and 1,023,000 lb. of the Conowingo machines. In overall diameter, however, it is first, measuring 43 ft. across; the diameter of the Niagara sets is 31 ft. 10 in. and that of those at Conowingo 37 ft. 4 in. So large is the frame of the stationary element that it is being made in six sections and will be dispatched unassembled without the coils and windings, because of their weight would greatly increase the difficulty of transportation, especially as the last few miles must be covered by motor tractor. The machine is to be ready for service by December 1st.

Uttoxeter.—Loan Sanctioned.—The Urban District Council has received sanction to a loan of £22,349 for the carrying out of an electricity scheme, under which energy will be obtained in bulk from the Burton-on-Trent Corporation.

Whitehaven.—Unemployment Scheme.—The Town Council has applied for sanction to a loan of £900 for relaying mains in a portion of the borough as an unemployment scheme.

Wolverhampton.—Electric Cooker Installation.—The Corporation Electricity Committee recommends the installation of electric cookers in 150 houses at a cost of £5 10s. per house.

Tramway and Railway Notes.

Aberdeen.—Railless Cars.—The Corporation Tramways Committee is contemplating the introduction of a railless-car system.

Canada.—Montreal.—Work is now proceeding actively on the construction of the new Montreal terminus of the Canadian National Railways, the cost of which has been estimated at $51,409,000. At the present time preparations are being made for the construction of a subway at Charlevoix Street, which is the first of those to be built at a cost of $2,500,000, between Turcot and Point St. Charles. Concurrently with the construction of these subways, work will be started on the main portion of the scheme, *viz.*, the Central Station itself and the new line linking it with the Victoria Bridge over the St. Lawrence. Excavation work is to be started on the site of the Central Station about May 1st. Other works to be started as soon as possible include the construction of a branch line in the eastern part of the City running from Hochelaga Street at Longue Pointe to Eastern Junction, a distance of approximately 10¼ miles. The whole scheme will involve the construction of more than 17 miles of new railway in order to link up existing lines and bring about the desired economies in operation.

Continental.—Switzerland.—Work is approaching completion on the electrification of the Rorschach-Heidenberg Railway, and it is expected that electric trains will be running over the section before the end of next month. Two electric locomotives for the line have been built by the Swiss Locomotive & Engineering Co., of Winterthur, in conjunction with the Oerlikon Co.

Belgium.—The local railway between Bruges, Knocke and Heyst is to be electrified at an estimated cost of about £70,000.

Glasgow.—Tramcar Accident.—A tramcar travelling westwards towards Dalmuir terminus late on April 12th left the rails at the junction of Dumbarton Road and Crow Road and overturned on to the pavement. One man was killed and more than fifty persons were injured.

India.—Riot Damage.—Political riots of a somewhat serious character occurred last week, during which the tramway services at Calcutta and Karachi were interfered with. A number of cars were broken and burned in the streets and many drivers and conductors were hurt.

Japan.—Railway Electrification.—The Japanese Government Railway authorities are reported to be planning to electrify the railways between Tokyo and Yokosuka; Kozu and Atami; Ueno and Abiko; Yokohama and Hachioji; Tachikawa and Asakawa; Kyoto and Nara; Tennoji and Umeda; and Otsu and Akashi.

London.—Annual Tramway Account Estimates.—At a recent meeting of the London County Council the Highways Committee submitted a report and the annual estimates in respect of the tramway undertaking for the year 1930-31. It was estimated that the total receipts including advertisement rents, &c., would amount to £4,429,300, and that the working expenditure, including renewals, special charges and contingencies, would be £3,604,725, which would leave a gross profit of £824,575. After deducting the net loan charges it was anticipated that there would be a net surplus of £89,411. Mr. F. B. Galer, who introduced the estimates, stated that this was the first occasion on which the Council could look back on a year which showed a profit and could estimate for an increased balance next year. The improved position was due very largely to the reorganisation of the undertaking and to the better service given to the public. The improvement in the speed of the cars had resulted in reducing the number of cars in use by 47, a sum of £84,700 per annum being saved thereby in running and maintenance charges. By the reorganisation of repair work the percentage of spare cars required had been reduced from 17½ to 10, and in order to run the existing services 122 additional cars would have been necessary. The saving on debt charges in respect of cars not purchased amounted to £31,400.

Preston.—Railless Cars.—The Corporation Tramways Committee recommends the substitution of railless cars on certain tramway routes at a cost of £25,000.

Telegraph and Telephone Notes.

Empire Telephony.—Anglo-Australian Radio Service.—Mr. J. A. Lyons, Commonwealth Postmaster-General, has announced that a wireless telephone service between Australia and Britain will be opened on April 30th at 6 p.m. The Commonwealth Prime Minister will speak from Canberra to the British Premier in London. A commercial service will then be available from both Melbourne and Sydney, the charge being £6 for a three-minute conversation.—*Reuter's* (Melbourne).

Germany.—Special Picture Telegraphy Cables.—In connection with the proposed picture-telegraphy service between Germany and America a contract has been placed with the Siemens & Halske Co. for the manufacture and laying of special cables necessary for linking the transmitting station at Nauen and the receiving station near Beelitz with the central operating station in Berlin. The technical specification of the cables has been worked out jointly by the German Post Office Engineering Department, the Telefunken Company, the Transradio Company, and the Siemens and Halske Company. The length of cable required between the Central Telegraph Office in Berlin and the transmitting station at Nauen is about 31 miles, and that between the receiving station at Beelitz and Berlin about 33 miles; their inductive loading will differ considerably from that of ordinary telephone cables. The new cables are to be used for picture transmission and also for transatlantic telephone service; in addition, they are to contain a number of ordinary telephone circuits. With a view to obtaining accelerated service on the new transatlantic line, the frequency limit will be considerably raised, with the result that it will be possible for a 4 in. by 4 in. picture with a screen of 5 lines per millimetre to be transmitted in less than one minute. The new cables will contain circuits for 36,000- and 16,000-cycle limit frequencies; the former circuits will permit of the employment of carrier frequencies up to 18,000 cycles and consequently of very rapid picture transmission. The circuits with the lower limit of frequency will enable a carrier frequency of 9,000 cycles to be used and they will be reserved for transmitting facsimile telegrams at a correspondingly lower speed. Some of the circuits for 16,000 Hertz limit frequency are also intended for the transatlantic telephone service, and the cable will also contain circuits for 3,500 and 2,700 limit frequencies, reserved for official communication between the operators and other special purposes. The cable between Berlin and Nauen will consist of eight double circuits with 1.9 mm. copper conductors for high-speed photo-telegraphy, and 42 double circuits of 0.9 mm. copper for the slower picture service as well as the transatlantic and ordinary telephone services. The cable between Berlin and Beelitz is to be equipped with double circuits of 1.9 mm. for high-speed picture telegraphy and 48 double circuits of 0.9 mm. for the other services. In order to attain the high-frequency limit values Pupin loading coils are to be inserted in the high-speed line at intervals of about one-third of a mile, whereas the distance between coils on the other line will be 1¼ miles. In the Berlin and Nauen areas the cables are to be laid in pipe conduits; elsewhere they are to be laid bare in the ground.

Iceland.—Radio Communication.—Parliament has resolved to terminate, as from January, 1932, the contract with the Great Northern Telegraph Company for cable connection between Iceland and the Shetland Islands. Wireless communication will be used instead, and *The Times* thinks it probable that the Government will accept an offer of the Marconi Company for telegraph and telephone services

between Iceland and foreign countries for £20,500. The Director of Telegraphs declares that the new method will mean a great saving, besides giving more dependable communication, as cable interruptions are now very frequent.

International Telephony.—British Services.—The British Postmaster-General states that Great Britain has "through" circuits to the following twelve countries: Austria, Belgium, Denmark, France, Germany, Holland, Irish Free State, Italy, Spain, Sweden, Switzerland, and the United States of America. By switching in an intermediate country service is provided from Great Britain to the following sixteen countries: the Argentine (Buenos Aires), Canada (all parts), Cuba (all parts), Czecho-Slovakia (all parts), Danzig Free City, Finland (parts), Gibraltar, Hungary (all parts), Lithuania (parts), Luxembourg (City), Mexico (parts), Norway (parts), Poland (parts), Portugal (Lisbon), the Sarre territory, and Spanish Morocco (Ceuta). All the services, except that with Buenos Aires, afford direct communication between subscribers' ordinary telephones, and are available at all hours of the day and night. There is no inherent difference, says the Postmaster-General, in the quality of service afforded to the public by means of an intermediate switch, as compared with services provided by means of through circuits.

Germany—Russia.—German protests against the restrictions placed by the Russian Soviet authorities upon the use of the newly-opened Moscow-Berlin telephone service seem to have been effective. The Soviet Commissar for Communications now states that on hindrance will be placed in the way of private communications. It is not clear, says *The Times*, whether the censorship has been withdrawn or whether an official ear has taken the place of the blue pencil.

The Telephone Service.—Chambers of Commerce Resolution.—At the annual general meeting of the Association of Chambers of Commerce last week, the following resolution, proposed by the London Chamber and seconded by the Newcastle Chamber, was carried unanimously:—"That, in the opinion of this Association, the time has arrived when steps should be taken to separate the administration of internal telephone and telegraph services from that of the postal service, and to invest the former in a semi-independent statutory authority which should include non-official representation. The Association urges, therefore, that an *ad hoc* committee be appointed by the Government to inquire into the practicability of effecting this reform, and further calls upon all individual Chambers to give the question local publicity with a view to educating public opinion throughout the country in favour of the proposal." The resolution was supported by Sir William Noble, late engineer-in-chief of the Post Office.

Radio Notes.

Battery Eliminators.—Swansea Recommendation.—The borough electrical engineer has reported to the Corporation Electricity Committee regarding the risks involved in the unauthorised connection of wireless set battery eliminators and other apparatus to domestic mains, and has pointed out that under the regulations in force in the borough it is necessary for consumers to notify the Corporation of any additional apparatus connected, or added, to their installations. His recommendation that a notice be published in the local Press to the above effect was approved.

Brazil.—Reception in Schools.—All secondary schools in San Paulo, Brazil, have been equipped with all-electric receivers, says Philips Radio, Ltd. Suitable programmes, compiled by a board of teachers, are followed with more than usual interest by the scholars.

France.—New Stations.—Test transmissions of the new Brumath plant, near Strasburg, are about to commence. Its initial aerial power will be 12 kW, but it may be increased later to 25 kW.

A wide appeal is to be made to all enthusiasts in Europe to subscribe towards the reconstruction of the Agen transmitter, which was destroyed by floods in the south of France in March last.

World-Radio announces that the Toulouse station is to be removed some 12 miles out of the town, and that its power is to be raised to 60 kW.

Imperial Broadcasting.—Service Extension.—It is understood that the Empire broadcasting service maintained by the B.B.C. from the experimental short-wave station (G5SW) at the Marconi Co.'s Chelmsford works is to be temporarily extended. Commencing on April 22nd and continuing for a month a news bulletin is to be transmitted each week-day from 5.55 to 6.15 p.m. B.s.t.

U.S.A.—Patents.—Messrs. Percival D. Lowell and Francis W. Dunmore, of Washington, D.C., have been given, by a decision rendered on March 20th by the Examiner of Interference of the Patent Office, priority in respect of the invention of the "all electric" radio receiving set, which can be operated from house-lighting circuits without batteries. Their claim had been contested by the Westinghouse Electric and Manufacturing Company, Wired Radio, Inc., and the Murad Radio Laboratories, Inc.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 5th. State Electricity Commission of Victoria. Supply of 22,000-V current limiting reactors. (B.X. 6226.)*

May 12th. Supply of 22,000-V pin-type supporting insulators for 12 months. (B.X. 6179.)*

May 20th. Posts and Telegraph Department. Terminal strips. (B.X. 6247.)* Telegraph instruments. (B.X. 6248.)*

Bedford.—May 5th. Electricity Department. Supply, delivery and erection of 11,000-V overhead lines and auxiliary apparatus (other than transformers) required for supplying an area of 100 sq. miles. (April 4th.)

Belgium.—April 30th.—Municipal authorities of Anderlecht. Supply of a quantity of h.p. and l.p. cable. Particulars (Cahier des Charges) for 3 francs from Régie de l'Electricité, 4, Rue Van Lint, Anderlecht, Brussels.

Bilston.—May 12th. Urban District Council. Installation of electric lighting in the Market Hall. (Registered contractors only.) (See this issue.)

Cheadle and Gatley.—May 6th. Electricity Department. Supply, delivery, and erection of an induction voltage regulator. (April 11th.)

Dundee.—May 10th. Electricity Department. Two electrically-driven circulating water pumps. (April 4th.)

Epsom.—May 12th. Urban District Council. (Section 1.) Supply of kiosks and converting plant. (Section 2.) Supply and laying of e.h.p. and l.p. cables. (Section 3.) Supply only of l.p. cables. (See this issue.)

Egypt.—July 15th. Ministry of Public Works, Mechanical and Electrical Department. Fifteen complete pumping stations at various sites in the Northern Delta; and switchgear for the Seru generating station. (A.X. 9437.)*

Gainsborough.—May 16th. Electricity Department. Twelve months' supply of paper-insulated, l.c., d.s.t.a. cables (l.p.) and single- and three-phase meters. (See this issue.)

Ilford.—April 28th. Electricity Department. Supply, delivery, and erection of converting plant of 500-kW capacity. (April 11th.)

London.—Central Electricity Board.—April 28th. Supply of 22-kV, 11-kV, and 66-kV switchgear for the North-West England and North Wales Electricity Scheme, 1928. (April 4th.)

May 5th. Supply, delivery, and erection of 33-kV transmission line, crossing of the river Witham, Boston. (April 4th.)

May 12th. Supply, delivery, and erection of 66-kV and lower voltage transmission lines, and switchgear for the Mid-East England Electricity Scheme, 1929. (April 4th.)

May 12th. Supply of 33-kV and other cables for the North-West England and North Wales Electricity Scheme, 1928. (See this issue.)

May 19th. Construction of site works, foundation works, and buildings in the area of the South-East England Electricity Scheme (London Area). (See this issue.)

St. Marylebone.—May 5th. Supply of l.p. and e.h.p. underground cables during the period June 1st, 1930, to May 31st, 1931. (April 18th.)

Bethnal Green.—April 30th. Borough Council. Supply, delivery and erection of h.p. and l.p. switchgear. (See this issue.)

Manchester.—May 5th. Electricity Committee. Supply and delivery for a period of twelve months of 125, 250, 500, 750 and 1,000-kVA static transformers. (April 18th.)

New Zealand.—WELLINGTON—May 6th. Public Works Department. 750-kVA transformers for Arapuni power scheme. (B.X. 6095.)*
May 13th. 110-kV transformers for Mangahao power scheme. (B.X. 6096.)*
May 20th. One 25-kVA, 3-phase, 400/230-V generator. (B.X. 6307.)*
May 27th. Supply of 110-kV suspension insulators for the Waitaki power scheme. (B.X. 6216.)* 110-kV suspension insulators for the Mangahao power scheme. (B.X. 6300.)*
June 24th. Outdoor steelwork and 110-kV switchgear for the Waitaki power scheme. (B.X. 6238.)*
May 13th. Posts and Telegraph Department. Terminal strips. (B.X. 6209.)*
June 25th. Condensers. (B.X. 6308.)*
July 16th. Government Railways. Four 30-cwt. overhead electric cranes for new goods sheds. (A.X. 9442.)*

Oswestry.—May 3rd. Electricity Department. Twelve months' supply of fuel and lubricating oils. (See this issue.)

South Africa.—CAPETOWN.—May 7th. Electricity Department. L.p. ironclad switchgear. (B.X. 6293.)*
June 4th. Heavy current d.c. testing motor-generator set. (B.X. 6341.)*

Staffordshire.—May 24th. Education Committee. Installation of electric light in the infants' council school, Pelsall. (See this issue.)

Stoke-on-Trent.—April 29th. North-West Midlands Joint Electricity Authority. Spraying with "Sidol" or creosote, wooden cooling towers at the central power house, Hanley. Painting chimney stacks at the central power house, Hanley. Supply of steam raising fuel during 12 months ending June 30th, 1931. (April 18th.)

Walthamstow.—May 3rd. Electricity Department. Supply, delivery and erection of one 2,500-kW motor convertor. (April 18th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Barnes.—Urban District Council. Accepted:—
Supply of cables (£1,660).—Derby Cables, Ltd.

Glasgow.—Police Committee. Recommended:—
Electric lighting installation for the various fire stations.—T. B. & J. A. Mathieson.
Transport Committee. Recommended:—
Axles with wheels and tires for roller bearing axle boxes.—John Baker & Bessemer, Ltd.
Block tin.—P. & W. MacLellan, Ltd.

London.—BATTERSEA.—Electricity Committee. Accepted:—
Switch for new e.h.p. feeder to Nine Elms sub-station (£773), two switches for existing e.h.p. feeders (£1,547), switches for No. 3 (10,000-kW) set and two switches for the two reactors, &c. (£6,564).—General Electric Co., Ltd.
BERMONDSEY.—General Purposes Committee. Accepted:—
Installation of intercommunication telephones at municipal offices.—Reliance Telephone Co., Ltd.
AIR MINISTRY.—Accepted:—
Supply of "Mazda" lamps for three months, with option of extension.—British Thomson-Houston Co., Ltd.

Stoke-on-Trent.—Hospital Committee. Accepted:—
Wireless installation at isolation hospital.—Barnett and Soans.
Electricity Committee. Recommended:—
Supply of e.h.p. and l.p. overhead transmission lines for 12 months.—Craven and District Electrical Construction Co., Ltd.
Public Works Committee. Accepted:—
Five electric motors (£116).—English Electric Co., Ltd.

Forthcoming Events.

Birmingham Electric Club.—Friday, April 25th. Grand Hotel, 7 p.m. "Some Aspects of American L.P. Control Practice." Mr. J. W. Donovan.

Junior Institution of Engineers.—Friday, April 25th. Monico Restaurant, Piccadilly Circus. 6.30 p.m. Annual dinner.

British Electrical Development Association (South Wales and Monmouthshire Area).—Thursday, May 1st. Royal Hotel, Cardiff. 12.45 for 1 p.m. Annual general meeting and luncheon.

Institution of Electrical Engineers.—Thursday, May 1st. Institution, Savoy Place, W.C.2. 6 p.m. Twenty-first Kelvin lecture. "Some Recent Advances in the Electron Theory of Metals." Mr. R. H. Fowler.

(Meter and Instrument Section).—Friday, May 2nd. Institution, Savoy Place, W.C.2. 7 p.m. "Metering Arrangements for the 'Grid' Transmission System in Great Britain." Mr. C. W. Marshall.

(South Midland Students' Section).—Monday, April 28th. Joint meeting with the Rugby Engineering Society at Rugby. Paper on "The Speed Torque Curve of the Squirrel Cage Induction Motor." Mr. N. F. T. Saunders.

(Western Centre).—Monday, April 28th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Testing of Porcelain Insulators." Mr. B. L. Goodlet.

Faraday Society.—Friday, May 2nd. Burlington House, W. 8 p.m. Lecture on "Coagulation." Prof. Dr. G. Wiegner. Friday, April 25th. 2.15 p.m. Annual general meeting. 2.30 to 7 p.m., and Saturday, April 16th, 10 a.m. to 4 p.m. Discussion on "Optical Rotatory Power."

Institute of Metals.—Wednesday, May 7th. Institution of Mechanical Engineers, Storey's Gate, S.W. 8 p.m. Annual May Lecture. "The Influence of Technique on Research." Major F. A. Freeth.

Notes.

Electricity in Iceland.

In a recent lecture before the Junior Institution of Engineers Mr. W. M. Hurrell dealt with the progress and scope for engineering in Iceland, saying that the demand for electricity is very great and has considerably outstripped the capacity of the power station, which is situated about six miles from the capital. The motive power is water and the maximum capacity of the station is 1,500 kW at 6,600 volts, 50 periods; the energy is conveyed by aerial cables to Reykjavik and there transformed to 250 volts for lighting and other domestic purposes. The water power is derived from adjacent streams which have been dammed, and only in very exceptional weather has a temporary shut-down been experienced on account of ice. Tenders have just been invited for the construction of a new station at Sog, near Thingvellir, to be equipped with two water turbo-alternators of a capacity of 4,500 kVA; the beautiful lake of Thingvellir will supply the water power. The smallest villages in Iceland have electric light, and in this respect as well as that of telephones, the country is well ahead of Great Britain. The available water power of the country is estimated at 4 million h.p. A new broadcasting station is being erected, but many of the wealthier people have wireless sets which pick up European stations.

There are three small engineering works in Reykjavik, one of which can make iron castings up to about one ton in weight, and a slip for ship repair work. Considerable use is made of electric and oxy-acetylene welding. The use of internal combustion engines is increasing and there are several small refrigerating plants about the country. The numerous hot-water springs are utilised for the heating of buildings, and just outside Reykjavik is a public laundry the water for which comes out of the ground at 98 deg. C.

The Domestic Rate.

The undermentioned undertakings should be added to the list of those supplying energy for heating and cooking at 1.0d. (or less) per kWh:—

Undertaking.	Engineer.	Primary charge (annual).	Secondary charge (pence per kWh).
Motherwell and Wishaw Corporation.	W. D. Brassington.	Min. kWh at 4d. (No. of rooms).	0.75
Bournemouth and Poole E.S. Co., Ltd.	E. Ll. Ingram.	10% R.V. (5% above £100) min. £2 10s.	1.0
Bury St. Edmund's Corporation.	A. E. Knights.	15% R.V.	1.0 less 0.5 disc.
Craven Hydro-Electric Supply Co., Ltd.	F. W. Lowcock (man. director).	R.V.	1.0

The following further particulars relating to the Bury St. Edmund's undertaking have been received:—M.D., 875 kW; kWh per head (all purposes) 78; kWh per consumer (all purposes) 830; gas, 11d. per therm; H, H-P, and AW schemes are in force.

The special heating and cooking rate for Falkirk Corporation given in our supplement should be implied. It consists of a standing charge of 30s. per annum plus 1d. per kWh for the first 5,000 kWh, 0.8d. for the next 5,000 kWh, and 0.8d. for all kWh in excess. For domestic lighting and heating the tariff is 40 kWh per room at 3.0d. (min. 120 kWh per annum) and 0.75d. for kWh in excess.

Artificial Sunlight.

"The experience of six months' use of the lamps indicates that ultra-violet radiation is a very valuable addition to our methods of treatment," states Dr. Ernest T. Roberts, medical officer of Glasgow Education Authority, in his annual report on the medical inspection and treatment of school children. Over 250 children received artificial sunlight treatment, and,

according to the report, with the exception of five cases, all who completed the full course showed considerable improvement. Cases appeared to show signs of improvement more quickly with the mercury-vapour lamp than with the carbon-arc lamp, though both types give good results.

Atomic Synthesis.

Prof. William D. Harkins, of the University of Chicago, U.S.A., has reported to the American Chemical Society that he had to take 34,000 photographs of the alpha particles of helium passing through nitrogen gas at the rate of 11,000 miles a second before he was able to get two which showed direct impact of helium atoms with nitrogen atoms, and the outcome of that collision and merger, namely, the formation of fluorine for an instant, and an explosive throwing off by the fluorine of an atom of hydrogen, leaving oxygen as the result. According to *The Times*, Prof. Harkins explained that he had been led to attempt the synthesis by a study of the atomic weights of the 91 known elements, which had shown him that the most stable and abundant were those in which the atomic weight was a multiple of four. As four is also the weight of the alpha particle of the helium atom cast off by radioactive metals during their disintegration, it occurred to him that he might be able to reverse the process of disintegration by shooting cast-off alpha particles of helium against other elements. He selected the alpha particles of helium cast off by thorium for his experiments, admitting about twelve of them at a time into a glass cylinder filled with nitrogen gas and supersaturated with water vapour. As the alpha particles passed through the gas they electrified it in their path, and the water vapour condensed in each path like a thread of steam. Each thread was made visible by powerful illumination, and a photograph was taken of them. Each photograph showed on an average twelve alpha tracks, but not until 10,000 photographs had been taken did any plate show one of the tracks stopping abruptly and splitting into two tracks, which revealed by their thickness, length, and direction the masses of two bodies which had produced these. Their mechanical characteristics made it possible to identify these bodies as oxygen and nitrogen. Nearly 24,000 other plates were exposed before he once more obtained a photograph showing the direct impact of a helium atom and a nitrogen atom within the field of the camera.

The Kingston Extensions.

The extensions at the generating station of the borough of Kingston-upon-Thames, which were inaugurated on April 9th by Sir John Brooke, C.B., vice-chairman of the Electricity Commissioners, and Lady Brooke, include a new 50,000-lb. boiler unit, a 3,750-kW turbo-alternator, and new e.h.p. and l.p. switchgear.

The steam-raising equipment comprises a Stirling five-drum water-tube boiler, with a Stirling integral superheater and a Green's tri-tube economiser. The boiler has a heating surface of 9,773 sq. ft., and the steam conditions are 225 lb./sq. in. and 750 deg. F. The economiser has a heating surface of 4,536 sq. ft. Under the boiler are two Babcock & Wilcox stokers of the enclosed type, each of the grates being 14 ft. long and 9 ft. wide. The grates embody a number of special features in order to ensure efficient burning of the fuel and adequate regulation at any load. The electric drive for the stokers embodies a four-gear change-speed device which, it is claimed, is positive in action and extremely simple in operation.

The turbo-alternator, supplied by the Brush Electrical Engineering Co., Ltd., is of the Brush-Ljungström type, and has an output, at the most economical load, of 3,000 kW when supplied with steam under the conditions named. The turbine is direct coupled to two alternators, having a combined output of 3,000 kW at 0.8 power factor, 3,300 volts, 50 cycles, 3-phase, 3,000 r.p.m. The turbine is fitted with a powerful automatic governor controlling the throttle valve through the medium of a pressure-relay system, which gives sensitive and positive governing. Adjustment of the governor is controlled by hand operation. The condenser is of the two-flow surface type, and is capable of dealing with 30,000 lb. of exhaust steam per hour, and maintaining a vacuum of 28¼ in. mercury with the barometer at 30 in., and circulating water at a temperature of 65 deg. F. Air is extracted from the condenser by means of a Brush-Delas two-stage ejector. The condensing water is delivered by means of a motor-driven centrifugal pump manufactured by Messrs. Mather & Platt, 3,750 gal. per min. The new e.h.p. switchgear, supplied by the General Electric Co., Ltd., comprises a new panel for the existing main switchboard in the station. The e.h.p. switchgear for the alternator is accommodated underneath a gallery in a sheet-steel cubicle, and is operated mechanically from the panel immediately above.

A recent development at Kingston-upon-Thames was the bulk supply to Walton-upon-Thames for which the following scheme was adopted: duplicate main feeder from the main generating station to a step-up sub-station; three 800-kVA step-up, three-phase transformers, sharing the load in parallel, and duplicate outgoing bulk supply feeders to Walton-upon-Thames, supplied by means of underground mains. The equipment for the bulk-suppy sub-station was also supplied by the G.E.C.

The extensions to the plant were carried out entirely under the supervision of the borough electrical engineer, Mr. T. A. Kingham, A.M.I.E.E.

American Cable Operation.

A report of the Underground Systems Committee, Engineering National Section, of the National Electric Light Association of America, covering the operating experience in 1928 of over 95 per cent. of the high-voltage underground cable in use in that country, indicates that the rate of failures of cables, joints, and potheads decreased considerably. The total rate of failures of cables and joints was 12 per 100 miles of cable per year, of which 36 per cent. was in joints. Cable failures due to internal causes during the first and second years of operation decreased markedly; the division of causes for cable failures was 20 per cent. inherent; 66 per cent. non-inherent; and 14 per cent. unknown. No failures occurred in the oil-filled single-conductor and 3-conductor cables. The rate of failure due to internal causes of single-conductor, 3-conductor shielded, and 3-conductor belted, paper-insulated cables were, respectively, 0.76, 0.78, and 1.67 per 100 miles per year.

Varnished-cambric and rubber-insulated cables were generally operating at stresses considerably below those of paper-insulated cables, and had 2.3 failures per 100 miles per year due to internal causes, as compared to 1.5 for paper-insulated cables.

The amount of single-conductor cable in use increased from 8 per cent. of the total installed in 1927 to 13 per cent. in 1928, and the corresponding increase of 3-conductor shielded cable was from 1 to 2.2 per cent. of the total in use.

The rate of failure of potheads was 5.1 per 1,000 potheads per year, which was more than twice the rate for joints.

Fifteen large companies employed various a.c. and d.c. testing sets, the main duty of which was to test new lines and effect repairs. Some companies started to make dielectric-loss tests on installed lines.

The total amount of all high-voltage cable reported in operation on December 31st, 1928, by 43 companies was 11,648 miles, as compared with 10,617 miles reported by the same number of companies the preceding year. For the 40 companies appearing in both reports the total amount of cable in operation was 11,450 miles at the end of 1928, and 10,569 miles at the end of 1927, which shows an increase of 881 miles, or 8.3 per cent.; the increase during 1927 was 14.7 per cent. Those figures included varnished-cambric and rubber-insulated cables.

B.S.S. for H.D. Copper Conductors.

British Standard Specification No. 125—1930, Hard-drawn Copper Solid and Stranded Circular Conductors for Overhead Power Transmission Purposes, has recently been issued. This is a revision of the 1924 edition, and differs from the previous issue only in certain minor points of an editorial nature designed to bring it into line with the 1930 revision of the B.S.S. for Aluminium Conductors for Overhead Power Transmission Purposes, No. 215. Specification No. 125 lays down standards for copper conductors with regard to the mechanical and electrical properties required for overhead power lines, and prescribes tests to ensure compliance with these requirements. The sizes of conductors are given in separate tables for primary and secondary standards, respectively, these tables being unaltered from the previous edition.

Copies of this specification may be otbained from the British Engineering Standards Association, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Educational.

London: Polytechnic, Regent Street.—Particulars appear in our advertisement pages of a course of six lectures on "The Thermionic Valve," by Mr. W. H. Date, B.Sc., commencing on May 7th.

Appointments Vacant.

Workshop superintendent (£600-£30-£780) for the Ceylon Government Telegraph Department.

Graduate assistant in engineering at Rutherford Technical College, Newcastle. (Burnham award scale.)

Assistant consumers' engineer (£300 per annum) for West Gloucestershire Power Co., Ltd.

Head of the Department of Mechanical Engineering (£600-£25-£700); assistant master in mathematics (Burnham scale); and teacher of workshop practice, electrical and motor engineering (Burnham scale), for the Central Municipal Technical School, Liverpool.

Chief engineer and manager, for the Nottingham City Electricity Department (£1,750 per annum).

(See our advertisement pages to-day.)

The Paisley Association.

At the annual general meeting of the Paisley Association of Electrical Engineers on April 8th office-bearers were elected as follows:—*President*: Mr. James E. Adam; *Vice-president*: Mr. H. Aberdein; *Hon. Secretary*: Mr. J. M. Barbour, Electricity offices, 27, Blackhall Street; *Hon. Treasurer*: Mr. Geo. H. Fisher; *Committee*: Messrs. G. U. Campbell, J. Durrell, J. S. Kilpatrick, F. F. Moss, L. R. Piper, and Alex. Todd; *Auditors*: Mr. Robert Gardner, and Mr. J. Rothera.

The Electrical Association for Women.

An electrical play entitled "A King in Amber," by A. B. Wright, was recently presented by the members of the Bristol Corporation Electricity Department Dramatic Society to members of the Bristol and District Branch of the Electrical Association for Women.

Institution Notes.

Institution of Electrical Engineers.

Mersey and North Wales (Liverpool) Centre.—At the annual general meeting on April 14th the following were elected to fill the vacancies occurring on the Committee for the 1930-31 session. *Chairman*: Mr. A. J. Pratt; *Vice-chairmen*: Mr. F. V. L. Mathias and Mr. P. M. Hogg; *Ordinary Members of Committee*: Mr. J. E. Allan, Mr. A. E. Malpas, Mr. R. A. Harrison Watson, and Mr. A. S. Wilson. *Hon. Treasurer*: Mr. L. Breach; *Hon. Secretary*: Mr. O. C. Waygood.

Informal Meeting.—At the informal meeting on April 14th Mr. W. Lang was in the chair when Mr. A. B. Eason opened a discussion on "Telephone Practice in Germany and Scandinavia." He showed a number of lantern slides illustrating Swedish and German apparatus, and compared the systems and procedure with our own, using exhibits to demonstrate that British practice assumed that much sturdier construction was necessary, while more elaborate safeguards and margins, bigger batteries, lines, jacks and plugs were also provided.

Major H. Brown, in discussing relative costs, said comparison could often be misleading, for the fact was overlooked that in Great Britain any eight people could together request a telephone service and it would be provided, which was not so in Sweden or in the U.S.A. A community of twenty subscribers in Sweden would be told to form a committee, provide exchange accommodation, build the line, and pay the operator, when the service would be installed. Climatic conditions in Sweden allowed untreated timber twenty years' life; in this country preserved poles certainly lasted longer, but they cost practically five times as much. To repave Stockholm might cost three shillings per square yard, but in London to open a yard of street often cost 20s., and in some situations gas and water main complications ran up the cost of conduit to as much as £30 a yard. Much of the remunerative work in the U.S.A. was not taken on the main service; some four million telephones in the U.S.A. were outside the Bell system.

Dr. R. W. King said his compatriots in the U.S.A. had natural pride in mass-production methods for which the telephone industry was an ideal application. Centralised manufacture and installation by trained crews organised after centralised study of conditions, had reduced costs enormously. Further, there was a keenness to apply new improvements continually. Improvements in vacuum tubes a year or two back had saved some ten million dollars a year. There had now been developed 18,000-pair lines instead of 15,000, thereby saving perhaps 5 million dollars a year; new alloys had recently decreased the size of the lines by one-third.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Highways Committee of the L.C.C. recently advertised the position of assistant rolling stock engineer in the Tramways Department. Forty-five applications were received and seven candidates were interviewed. As a result the Committee recommends the appointment of Mr. G. F. Sinclair to the position at a salary of £1,000 per annum rising by £50 annually to £1,200.

The *South African Engineer* reports that the Johannesburg City Council has appointed Mr. A. T. Rodwell, M.I.E.E., M.I.Mech.E., as general manager of its Electricity Department, at a salary of £2,000 per annum, plus "locomotion allowance" at £17 10s. per mensem. Mr. Rodwell has some 23 years of service in the department to his credit, and has been acting general manager for a considerable period, during the illness of the late Mr. Bernard Sankey, and since the latter's death.

Mr. G. C. Hadfield has been appointed manager of the Nottingham Electricity Department's showrooms. He has held similar positions at Wolverhampton and Southport.

Mr. H. J. Harper, B.Sc., district engineer to the Yorkshire Electric Power Co., has been appointed mains engineer to the Hackney Electricity Department. There were 46 applicants for the position.

Councillor W. C. Davey (of W. C. Davey & Co., telephone and electrical engineers, Hackney) and Mrs. Davey celebrated their golden wedding on April 12th.

Mr. P. S. Hopkins has resigned his position as general manager of the Standard Oil Company of New York (North China Department) to take charge of the Chinese interests of the American and Foreign Power Co., whose subsidiary, the Shanghai Power Company, acquired last year the municipal electricity undertaking of Shanghai. As part of his duties with the American and Foreign Power Co., Mr. Hopkins will become president of the Shanghai Power Company, and chairman of its Advisory Board.

Sig. Renzo Norsa, of the Compagnia Generale di Elettricita, Milan, has been appointed honorary secretary for Italy of the American Institute of Electrical Engineers in succession to the late Signor Guido Semenza. Signor Luigi Emanueli has been appointed to succeed Signor Semenza as hon. secretary for Italy of the Institution of Electrical Engineers, London.

Mr. F. W. T. Bradley, late sub-station engineer to the Durban Corporation, resigned his position at the end of last year in order to take up an appointment with Messrs. Thos. Barlow & Sons (S.A.), Ltd., as chief assistant engineer, but owing to a breakdown in health has been compelled to sever his connection with them. He is now making satisfactory progress towards recovery.

Mr. Gregory Walker, mains superintendent to the Blackburn Corporation, was taken suddenly ill while driving his car on April 17th. He stopped the car and, getting out, collapsed on the footpath. A passer-by drove him to the infirmary.

The marriage took place on April 5th at Chingford, Essex, of Mr. Reuben F. Winder, A.M.I.E.E., of Croydon, and Miss Doris Joan Gravatt, of Chingford.

The marriage took place at Scarborough on April 19th of Mr. H. Brickley and Miss R. Brown, of Stockport.

The Grange-over-Sands Urban Council has increased the salary of its electrical engineer by £50 per annum as from April 1st.

The Bedford Town Council, on April 16th, received from the Electricity Committee a report that the salaries of the technical staff should be increased as from July 1st next owing to the station having been transferred from Class F to Class E of the N.J.B. Schedule. As some members of the Council desired more information on the subject, it was agreed to refer the report back to the Committee, which will submit it again at the next meeting of the Corporation.

The marriage took place on April 19th at Sparkhill, Birmingham, of Mr. Stuart F. Philpott, A.M.I.E.E., of the Garrard Engineering and Manufacturing Co., Ltd., Swindon, and Miss Nellie R. Green, of Sparkbrook, Birmingham.

Mr. Osborne Mitchell, editor of *Electrical News & Engineering*, Toronto, sailed from New York for London on April 12th, and expects to be in England from April 22nd to May 17th.

Obituary.—Mr. A. W. Tait.—We regret to report the death of Mr. Andrew Wilson Tait, C.B.E., which occurred at his residence, Holland Park, W., on Monday last. He had been in ill-health for some time past, and in consequence had been compelled to resign from the boards of some of the companies with which he was connected for many years. He was an accountant, being a partner in the well-known firm of Messrs. George A. Touche & Co., and he gained a considerable reputation as a financial authority in matters connected with industry. His interests were very largely electrical, the companies of which he was a director including Ferranti, Ltd., Bruce Peebles & Co., Ltd., the British Aluminium Co., Ltd., the North British Aluminium Co., Ltd., the London Power Co., Ltd., the Metropolitan Electric Supply Co., Ltd., the Lochaber Power Co., the Chesham, Uxbridge and Brentford Electric Supply Companies, the Barbados Electric Supply Corporation, Ltd., the Delhi Electric Tramways and Lighting Co., Ltd., and the Foundation Co., Ltd. He was awarded the C.B.E. in 1918 for his services in connection with a number of Government committees. Mr. Tait was 54 years of age; he leaves a widow, a son and a daughter. The funeral was to take place yesterday (Thursday).

Mr. F. King.—The death has taken place at the age of 82 years of Mr. Frederick King, head of the firm of King and Co., electrical engineers, Bristol.

Will.—The late Dr. Hugh L. Callendar, Professor of Physics at the Imperial College of Science and Technology, left estate valued at £8,154 (£7,298 net personalty).

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Nelson & District Wireless Service, Ltd.—Private company. Registered April 12th. Capital, £400 in £1 shares. Objects: To carry on the business of relaying by wire wireless signals and television transmission, to establish, work and manage wireless transmitting and receiving stations, &c. The directors are: N. Plunkett, 6, Gladstone Terrace, Gisburn Road, Barrowford; P. Brown, 1, Garnett Street, Barrowford; F. Simpson, 33, Vernon Street, Nelson; C. Smithson, "Arnside," Halifax Road, Nelson. Registered office: 27, Every Street, Nelson, Lancs.

Dodds & Atkinson, Ltd.—Private company. Registered April 11th. Capital, £500 in £10 shares. Objects: To carry on the business of electrical, lighting, heating, wireless, mechanical and general engineers and engineering contractors, &c. The permanent directors are: A. W. Dodds, 11, Wensley Road, Harrogate, manufacturers' agent; R. J. Atkinson, 34, Leeds Road, Harrogate, electrical engineer.

Turner Radford & Co., Ltd.—Private company. Registered April 11th. Capital, £2,000 in 1,500 8 per cent. cumulative preference shares of £1 each and 2,000 ordinary shares of 5s. each. Objects: To acquire the business of radio and electrical suppliers carried on by A. D. Turner and C. L. Radford at 90, High Road, Wembley, Middlesex. The directors are:—A. D. Turner, 31, Elm Road, Wembley, Middlesex; C. L. Radford, 4, Princes Court, Wembley, Middlesex. Registered office: 90, High Road, Wembley, Middlesex.

Mysta, Ltd.—Private company. Registered April 11th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in sound-recording and reproducing instruments, and apparatus and devices for recording, transmitting, reproducing and amplifying sound, in connection with kinematograph or other pictures; and to acquire the trade mark "Mysta." The directors are: R. T. Knight, 18, Dagnan Road, Balham, S.W.12, automobile engineer; S. M. Johnston, 9, Gordon Street, W.C.1, business manager. Secretary: F. Fullerton, 6, Peristone Road, Streatham Common, S.W.16. Registered office: Pomeroy House, 28a, Basinghall Street, E.C.2.

Northampton Radio, Ltd.—Private company. Registered April 14th. Capital, £100 in £1 shares. Objects: To carry on the business of merchants, brokers, commission agents, importers, exporters and manufacturers of and dealers in electrical and wireless goods, cycles, gramophones, electric light, and general electrical engineering tools, &c. The subscribers are: W. H. Ward, 37, Sheep Street, Northampton, salesman; S. G. Grimes, 150, Southampton Row, W.C.1, C.A. Secretary (*pro. tem.*): S. G. Grimes. Registered office: 28, St. Giles' Street, Northampton.

Arnals, Ltd.—Private company. Registered April 8th. Capital, £2,000 in £1 shares. Objects: To acquire the business of a wholesale dealer in radio and electrical sundries now carried on by B. Barker at 44, Curzon Street, Derby, as "The Curzon Street Radio Stores." The permanent directors are: B. Barker, Hill Crest, Chaddesden, Derby, engineer; A. G. Robinson, 8, Rock Villas, Madeley Street, Derby, merchant. Solicitor: Geo. F. Knighton, B.A., 8, Market Place, Derby.

Robsons (Liverpool) Trading Co., Ltd.—Private company. Registered April 9th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, lighting, mechanical, and gas engineers, boilermakers, founders, ship-builders and repairers, manufacturers of and dealers in dynamos, motors, electric hammers, &c. The subscribers (each with one share) are: W. Kenyon, 20, North John Street, Liverpool, solicitor; J. W. Dury, 55, Wilburn Street, Liverpool, clerk. Solicitors: Luya & Williams, 20, North John Street, Liverpool.

Radio Cushions, Ltd.—Private company. Registered April 10th. Capital, £2,625 in 2,500 8 per cent. cumulative participating preference shares of £1 each and 2,500 ordinary shares of 1s. each. Objects: To carry on the business of electricians, mechanical engineers and manufacturers, workers and dealers in electricity, sound conveyed by electricity and/or radio, &c. The permanent directors are: P. J. F. Kops, 19, Eastcheap, E.C.3, merchant; H. Balkwill, 71, Eastcheap, E.C.3, tea broker. Secretary: P. J. F. Kops.

Solvolite, Ltd.—Private company. Registered April. 9th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of and dealers in electricity, motive power and light, founders, &c. The first directors are:—J. Broomhead, mechanical and electrical engineer, and L. F. L. Scott, accountant (director of Woodscott Electrical Co., Ltd.), 255, Dickson Road, Blackpool. Registered office: 255, Dickson Road, Blackpool.

Bankers Industrial Development Co., Ltd.—Registered on April 15th, as a private company. Capital, £6,000,000 in £100,000 shares (45 "A" ordinary and 15 "B" ordinary). The objects are to investigate and advise on all manner of financial, industrial and economic questions, and to become a member of, or be represented in, any board, committee, council, association or body, having for its objects, or one of its objects, the investigation of any such questions; to aid in the formulation and carrying into effect of all manner of schemes and arrangements for, or relating to, the financing, development, co-ordination, amalgamation, re-construction or re-organisation in any manner of partnerships, companies, corporations, businesses and undertakings of all kinds; to acquire, deal in and dispose of shares, stocks, bonds, debentures, debenture stocks or other securities, to carry on a general financial business and general financial operations of all kinds. The subscribers are: M. Norman, Governor, Bank of England; N. L. Campbell, director, Helbert Wagg & Co., Ltd., 41, Threadneedle Street, E.C. The directors are to appoint an Advisory Council, consisting of influential persons engaged in financial business. Secretary: John A. Roney. Registered office: 5, London Wall Buildings, E.C.2.

R. Langston Jones & Co., Ltd.—Private company. Registered April 14th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical appliances, fittings and accessories, &c. The directors are: S. Grundy (director Conrad Parlanti, Ltd.), electrical engineer; Mrs. B. W. Grundy, and K. A. S. Grundy, electrical engineer, all of "Woodbank," Teddington Park Road, Teddington; A. W. Grundy, 36, Elmfield Avenue, Teddington, (director Conrad Parlanti, Ltd.). Registered office: 38, High Street, Teddington.

Official Returns of Electrical Companies.

Fryer & Hartley, Ltd.—Satisfaction in full on March 3rd, 1930, of mortgage dated April 7th, 1925, and registered April 16th, 1925, securing £800.

K. N. Electrical Products, Ltd.—J. M. Ferguson, Staple Inn Buildings, W.C., was appointed receiver on March 26th, 1930, under powers contained in debentures dated December 7th, 1928, and May 30th and August 10th, 1929.

Energo Products, Ltd.—S. G. Grimes, 150, Southampton Row, W.C.1, ceased to act as receiver on March 29th, 1930.

White, Jacoby & Co., Ltd.—Capital, £7,500 in £1 shares. Return dated January 13th, 1930. 5,794 shares taken up. £3,437 paid. £2,357 considered as paid. Mortgages and charges, £1,500.

Radio Experts, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1929. 200 shares taken up. £250 paid. Mortgages and charges, nil.

J. Segal, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1929. 990 shares taken up. £10 paid. £980 considered as paid. Mortgages and charges, nil.

Nefa Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 24th, 1929. 999 shares taken up. £999 paid. Mortgages and charges, £500.

Bann Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated January 14th, 1930. 8,002 shares taken up. £8,002 paid. Mortgages and charges, nil.

Armorduct Cable Co., Ltd.—Particulars filed of £4,000 debentures (inclusive of £3,000 already registered) authorised April 4th, 1930, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Burma Electric Supply Co., Ltd.—Capital, £270,000 in 150,000 preference and 120,000 ordinary shares of £1 each. Return dated December 25th, 1929. 120,000 preference and 120,000 ordinary shares taken up. £100,000 paid on 100,000 preference shares. £140,000 considered as paid on 20,000 preference and 120,000 ordinary shares. Mortgages and charges, nil.

Lancashire Telephone Systems, Ltd.—Capital, £10,000 in 5,000 participating preference and 5,000 ordinary shares of £1 each. Return dated January 14th, 1930. 700 preference and 4,380 ordinary shares taken up. £4,330 paid (being £1 per share on 700 preference and 3,380 ordinary, and 5s. per share on 1,000 ordinary). Mortgages and charges, £1,600.

International Hydro-Electric Development Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated December 4th, 1929. 2,744 shares taken up. £2,744 paid. Mortgages and charges, nil.

Lymington Electric Light & Power Co., Ltd.—Satisfaction to the extent of £10,000 (being amount issued) on January 1st, 1930, of trust deed dated September 26th, 1902, and registered October 7th, 1902, securing £10,000 debentures then made, and a further issue of £10,000 debentures if made thereafter.

Essaness Radio & Electrical Co., Ltd.—R. H. Hopkins, 418, Strand, W.C.2, was appointed receiver and manager on March 31st, 1930, under powers contained in debentures dated February 16th, 1928.

Power & Traction Finance Co., Ltd.—Capital, £250,000 in £1 shares. Return dated February 5th, 1930. 6,002 shares taken up. £6,002 paid. Mortgages and charges, nil.

Barbados Electric Supply Corporation, Ltd. — Capital, £60,000 in £1 shares. Return dated December 30th, 1929. All shares taken up. £38,051 paid, £21,949 considered as paid. Mortgages and charges: £18,000.

British Electrical Instruments, Ltd.—Capital, £1,000 in £1 shares. Return dated November 26th, 1929. All shares taken up. £1,000 paid. Mortgages and charges: £400 debenture.

Pickvance, Ltd.—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated December 30th, 1929. 600 preference and 1,002 ordinary shares taken up. £650 paid on 450 preference and 200 ordinary shares, £952 considered as paid on 150 preference and 802 ordinary shares. Mortgages and charges: £2,000.

Electro-Mechanical Supplies, Ltd.—Capital, £3,000 in £1 shares. Return dated January 14th, 1930. 999 shares taken up. £999 paid. Mortgages and charges, nil.

Consolidated Signal Co., Ltd.—Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. Return dated March 13th, 1930. 214,195 preference and 150,548 ordinary shares taken up. £52,839 paid on 24,999 preference and 27,840 ordinary shares, £311,902 considered as paid on 189,196 preference and 122,706 ordinary shares. Mortgages and charges, nil.

City Notes.

British Thomson-Houston Co., Ltd.

Mr. W. C. Lusk (chairman) presided at the annual meeting on April 16th, and in the course of his speech referred to the resignation of Mr. H. C. Levis, the chairman, and to the appointment to the board of Sir Felix J. C. Pole, chairman of Associated Electrical Industries, Ltd., and Mr. G. M. Campbell. Dealing with the accounts (*vide* our last issue, p. 744), he said that the expenditure for additions during the year amounted to £149,720 (as compared with £137,030 for the previous year) and against this there was written off for depreciation £140,125 (as compared with £105,930). Both the orders received and the shipments from the factories during the year were greater than for the previous year, but the continuation of excessive competition at home and abroad resulted in an unreasonably low level of prices. Mr. Lusk said that Great Britain was the only important electrical manufacturing country in which the manufacturers received no protection in their home market; and one had only to examine the balance sheets of the large electrical manufacturers in other countries to see the advantage to them of a protected home market and the disadvantage at which the British manufacturer was placed. Moreover, due to the protection of the markets in the other important manufacturing countries, it was next to impossible for the British manufacturer to sell his products there. In addition to that, manufacturers in Continental countries had the advantage of lower rates of wages than were paid in this country. The budget introduced the previous day placed serious additional burdens upon the already heavily handicapped British manufacturer. Co-operation with the other companies of the Associated Electrical Industries group was pursued during the year, and that policy would be steadily followed and extended. One result of that policy was the transfer of the wiring supplies and radio businesses to the Edison Swan Electric Co., Ltd., in August last. Many articles of those lines continued to be manufactured by the B.T.H. Co., but all selling and distribution was now done by the Edison Swan Co. The company continued to maintain its position as a leader in electrical engineering development. A turbo-alternator set was now being manufactured at Rugby for an important lighting and power company in America which would use steam at a temperature of 1,000 deg. F., the highest temperature for which a steam turbine had ever been built. For the Ford Motor Company's new plant at Dagenham the company was supplying a turbo-alternator set of 30,000-kW capacity to operate at a steam pressure of 1,200 lb. per sq. in. The company was making for the London Power Company's station at Battersea a turbo-alternator set of 67,200 kW, a twin set being manufactured by an associated company, the Metropolitan-Vickers Electrical Co.; these, he said, were the largest generating units yet built in a British factory. The company had been a pioneer in this country of electric propulsion for ships; it supplied turbo-electric propelling equipment ten years ago to the first of the electrically-driven ships of the United Fruit Co., and it had also provided the turbo-electric equipment for the *Viceroy of India*, the largest passenger liner yet equipped for electric drive, which was put into service during the past year. The results obtained had been so satisfactory that Lord Inchcape had decided to employ the same form of drive for two still larger vessels for the P. & O. Australian service, the turbo-electric equipment for which the B.T.H. Co. was now manufacturing. The company also had in hand orders for other shipowners for turbo-electric equipment for three fruit-carrying ships, and two equipments for Diesel-electric driven oil tankers, these being repeat orders. They received during the year a share of the orders placed by the Central Electricity Board for 132,000-V switchgear and transformers; and the first of the 132,000-V sub-stations to be put into service, namely, the Bonnybridge sub-station of the Scottish Grid, was equipped with switchgear of the company's make. In collaboration with the engineers of the Automatic Telephone Manufacturing Co., Ltd., the company had developed and successfully demonstrated an all-electric automatic totalisator, and the Racecourse Betting Control Board had placed several contracts with them. The report and accounts were adopted; Col. T. W. Pragnell, D.S.O., was elected a director of the company, and the retiring directors and auditors were re-elected.

English Electric Co., Ltd.

This company's report for 1929 was reviewed in our last issue (p. 744). Mr. W. L. Hichens (chairman) presided at the annual meeting on April 17th, and in the course of his speech referred to the death of Sir Alexander Gracie, who had been a director of the company since its inception. He said that the scheme of reconstruction had been approved by the debenture holders and awaited the sanction of the Court. When the scheme was approved a reconstructed balance sheet would be issued setting forth the changes which were being made. The loss for the past year was greater on account of the slightly lower output and the continued fall in prices; the works efficiency had improved, however. A new switchgear bay had been erected at the Stafford works, and a new brass foundry had been established. They had disposed of part of the Coventry Ordnance works and the Preston pattern shop at favourable prices. The actual expenditure on development during the year had amounted to £53,000, but much more remained to be done. The reconstruction scheme would provide the necessary funds for the carrying out of needed developments to effect further economies in production costs. The future policy of the company would be framed by the new board which would be appointed under the terms of the reconstruction scheme. Some time must elapse, however, before the scheme had full effect.

Mr. A. B. Clarke (a shareholder) maintained that only one-fifth of the capital was represented by assets, taking only the book value of these. He attributed the company's position to "reckless inflation." He compared the results with those obtained by other electrical companies, and said that the comparison showed that the times were not so bad as the directors stated. Mr. B. S. Strauss said that the company had suffered all along from over-capitalisation through its taking over companies at inflated valuations. He asked whether if the reconstruction scheme had been in operation the year's activities would have shown a profit. He also asked when Messrs. Lazard Bros. were going to put up the capital under the terms of the scheme. In conclusion, he urged the directors to give more attention to increasing the turnover. It was better to do that, and so reduce the percentage of overhead charges, than to seek increased profits on a small turnover.

Another shareholder asked what the loss would have been if the correct amount of depreciation had been allowed, and what the auditors considered a proper rate for depreciation.

Replying to these questions, Mr. Hichens said that if the reconstruction scheme had been in operation, the accounts would have about balanced. The scheme would reduce the burden of interest and wipe out the bank overdraft, but, apart from these financial advantages, it would enable them to undertake important schemes for securing efficiency which at present they were unable to finance. There should be a greater turnover as a result of Messrs. Lazard Bros.' influence in many countries; it was also an advantage in business to be financially stable. The directors fully appreciated the importance of turnover, but so did everybody in the basic in-

dustries of the country, with the result that prices had been cut to a serious extent. The company had not been remiss in the securing of orders; in fact, it had done well in the circumstances. It was not easy to maintain a big turnover when prices were falling and fixed charges remained stationary. Messrs. Lazard Bros. were awaiting the approval of the scheme before providing the promised capital. He agreed that the amount allowed for depreciation was inadequate; the same amount would probably be sufficient when the capital was written down. In reply to a further question, Mr. Hichens said that he had been informed that one gentleman had announced his intention of opposing the scheme in the Court, but there was a very large majority in favour of it.

County of London Electric Supply Co., Ltd.

The annual meeting of this company was held on April 16th. Sir Bernard Greenwell presided in the absence of Sir Harry Renwick, and read the chairman's speech. In presenting the report and accounts, the chairman said that last year and the year before the progress shown was largely due to certain bulk supplies and supplies to specially large consumers connected to the mains during those years. On the present occasion, however, the expansion was in every department. The company now had an area of approximately 1,500 sq. miles, and with its associated companies, to whom it gave bulk supplies, a total of approximately 3,200 sq. miles. Reductions during the past year both in the flat rate and two-part tariff charges amounted approximately to £265,000, and the charges for lighting on flat rates had been reduced by 37½ per cent. since the war. Their application to the Electricity Commissioners for consent to extend the Barking power station was still under consideration. The second section of the power house was not in full commercial use before the close of the year, but it had since been practically completed, and was now running satisfactorily. The operating efficiency of the power station had improved considerably during the past year, and the thermal efficiency now closely approximated to the highest so far obtained at any station in this country, and compared favourably with stations in America, where the highest thermal efficiencies were alleged to have been obtained. The output of the power stations in 1922 was only 71,500,000 kWh, whereas last year the total was 426,500,000 kWh. On the distribution side, a considerable amount of work had been done in the Essex area during the year, and supplies had been established at a number of points. The associated companies recorded continued progress. The electrical industry as a whole had weathered the general trade depression in an extraordinary manner, and he ventured to think that that was due in a great measure to the enterprise of the industry itself. As regarded the national consumption of electricity for 1929 from public sources, this was estimated as some 13 per cent. greater than for 1928, and was an improved increase over that of the previous year. The company showed an increase in the sales of energy over 1928 of 16 per cent., while the output for domestic purposes showed an increase of 24 per cent. As to the progress in the current year, the first three months showed an increase in electricity sold of 20 per cent. as compared with the corresponding period of the previous year; the connections had increased by 10,051; and the number of consumers by 4,447. The report and accounts were adopted.

Everlite, Ltd.

Presiding at the annual meeting of this company on April 16th, the Marquess of Winchester (chairman) said that they had been fortunate in that their associated company, Metduro, Ltd., possessed a valuable factory estate at Waltham Abbey, and they had been able to take on lease from that company a self-contained factory with ample floor accommodation which was suitable in every way for their requirements, with room for all the expansion that they would need in the future. During the early part of 1929 a certain number of Everlite lamps were manufactured, but these were found to be too expensive to command a wide market, and placing them on the market was deferred until a more suitable one at a competitive price could be produced. They could now offer the trade a lamp which could be utilised for many purposes by the addition of special fittings. Other designs were being tested, chiefly in the direction of adapting the lamp for household purposes. They were satisfied now that they had produced one which was "fool-proof" and, they believed, would command a large sale in overseas countries in which the only form of illumination was by paraffin oil or candles. Their trade marks had been registered in over 70 countries, and they had received many inquiries from Continental countries and from the Dominions regarding the rights for those countries. The report and accounts were adopted.

German Loan in New York.

An American banking group headed by Dillon Read & Co., of New York, made an issue last week of $15,000,000 (£3,000,000) 6 per cent. 25-year debentures of the Berlin City Electric Company ("Bewag"). The loan was priced at 90½ per cent., and a substantial portion was reserved for placing in Europe. An unusual feature of the issue, indicating the extent to which German credit has improved since the acceptance of the Young Plan, is the fact that, in place of the usual obligatory sinking fund provisions, a purchase fund of $310,000 (£62,000) per annum, to be exercised only when the bonds are at or below par, has been substituted for redemption purposes. This means, in effect, that, instead of little more than half the total amount of the loan being available for use during the whole average duration of the loan, about three-quarters of the total will be available. The Berlin City Electric Company operates under a 50-year lease from the city and supplies 90 per cent. of the electricity consumed in the German capital.

London Electric Wire Co. & Smith's, Ltd.

Presiding at the annual meeting of this company on April 15th, Sir George H. Fisher-Smith (chairman) said there was still further development to be carried through in its subsidiary, the Liverpool Electric Cable Co., Ltd., although considerable progress had been made in regard to new buildings and plant, which, if necessary, could be quickly extended to meet any increased business. The business of their company had continued to expand during the year under review in face of increasing competition. Throughout the year competition in home and overseas markets had increased, and it had been necessary to meet it by making a thorough review of each undertaking and every department which it contained, introducing, wherever necessary, improved methods and the most up-to-date machinery, while at all times exercising the strictest economy. He thought they could look to the future with every confidence, knowing that the financial position of the company was extremely sound. The report and accounts were adopted.

Babcock & Wilcox, Ltd.

The net profit for the year ended December 31st last was £674,316, as compared with £734,902 for 1928. A contribution to the staff pension fund (£8,786) is deducted, and a balance brought forward of £118,362 is added, making £783,893. The final ordinary dividend is 8 per cent., free of tax, making 15 per cent. for the year. The reserve fund receives £48,000 (against £50,000), leaving £75,991 to be carried forward. The report states that the reduction of the profit for the year is in a large measure accounted for by an exceptional accumulation of uncompleted orders, due to circumstances beyond the company's control. The associated and subsidiary companies on the whole continued to give satisfactory results. Since the last meeting Lt.-Col. J. H. M. Greenly has been appointed a director. Meeting: May 5th.

South Metropolitan Electric Light & Power Co., Ltd.

The report for the year ended December 31st last shows a profit of £209,441, to which is added £125,076 brought forward, making £361,517. After deducting debenture interest, &c., transferring £20,000 to taxation reserve, £44,722 to depreciation, and £10,000 to investment reserve, there is a balance of £218,112. It is proposed to pay a final dividend of 6 per cent. on the ordinary shares, making 9 per cent. for the year, and to carry forward £147,612. The electrical energy sold increased by 7,247,833 to 46,399,945 kWh. During the year two-part tariffs were introduced both for domestic and business consumers, and reductions were made in the flat rate for lighting and in the two-part tariffs. Meeting: April 30th.

South London Electric Supply Corporation, Ltd.

The revenue account for 1929 shows a balance of £124,380, to which is added £95,397 brought forward, making £219,777. From this £15,000 is allocated to taxation reserve, £24,506 to sinking funds, £35,000 to change of system expenditure suspense account, and £2,200 to contingency fund, leaving a balance of £142,651. A final dividend of 5½ per cent. is recommended on the ordinary shares, making 8½ per cent. for the year, leaving £98,861 to be carried forward. The energy sold during the year totalled 22,817,943 kWh, an increase of 3,237,821 kWh. A scheme has been formulated for changing the system of supply to the standard system. Meeting: April 30th.

Cammell, Laird & Co., Ltd.

The report for the past year shows that the profit, after providing for debenture interest and depreciation, was £11,810 (against a loss of £80,694 in 1928). The addition of £5,121 brought forward makes £16,931, which is to be carried forward. With the report the directors circulated a scheme by which it is proposed to ask the holders of the company's 5 per cent. first mortgage debenture stock and 4½ per cent. debenture stock to agree to an extension of five years in the term of the debentures. In consideration of this the interest will be raised to 5½ per cent., and it is agreed that no dividend shall be paid on any part of the share capital until the issues have been repaid.

Edison Swan Electric Co., Ltd.

The annual meeting was held on April 16th, Mr. C. F. Spencer (chairman) presiding. In presenting the report and accounts (Elec. Rev., April 11th, p. 699), the chairman said that the Cable Company was actively occupied. He referred to the taking over, during the past year, of the merchandise business, other than lamps, of the British Thomson-Houston Co., Ltd., and stated that probably at the end of next month the business of Metro-Vick Supplies would be merged with the company. A number of branches were added during the year. The profit was in excess of the previous year, and was therefore satisfactory. The report and accounts were adopted.

Associated Electrical Industries, Ltd.

The report for the year ended December 31st, 1929, shows a total profit of £365,961, to which is added £101,851 brought forward, making £467,820. After providing for debenture interest, &c., and depreciation, and transferring £15,273 there is an available balance of £348,389. The preference dividend is paid and the ordinary shares receive 6 per cent.; a balance of £109,241 is carried forward. The report says that all the works of the group were comparatively well employed during 1929, and the output has been satisfactorily maintained. Orders in hand show an increase over those of the previous year. The resignation from the board of Mr. H. C. Levis, Mr. B. D. F. Docker and Sir Edmund Wyldbore Smith. Sir Felix J. C. Pole is now chairman, Mr. W. C. Lusk, deputy-chairman, and Mr. C. E. Lloyd has been appointed a director. Meeting: April 30th.

Scottish Southern Electric Supply Co., Ltd.

Mr. George Balfour, the chairman, gave details of extensions and developments at the recent annual general meeting of the company. He said that the energy sold during the year amounted to 4,273,233 kWh, as compared with 2,932,828 kWh for 1928. The extension of transmission lines and distribution systems in the extended area of supply had been continued, involving the provision of 10¾ miles of e.h.p. lines and 5¼ miles of l.p. distributors. Including the mains taken over with the Jedburgh undertaking, the company's transmission and distribution system now comprised about 64 miles of h.p. lines and 45 miles of l.p. mains. During the year 237 new consumers were secured. A large number of consumers were availing themselves of the company's "all-in" domestic tariff.

Cork Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a revenue of £149,101. After deducting expenses (£96,414), debenture interest, &c., transferring £7,787 to depreciation and renewals, £12,500 to general reserve, and adding £14,170 brought forward, there is a balance of £38,334. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 10 per cent. for the year, leaving £17,221 to be carried forward. The electrical energy sold increased from 7,732,325 to 12,978,011 kWh. and the number of passengers carried by the tramway system from 806,891 to 832,577.

Hopkinsons, Ltd.

The profit for the year ended January 31st last, after meeting expenses, depreciation, &c., was £78,628, as compared with £94,708 in the preceding year; £19,311 brought forward is added, making £97,939. The income tax allocation is £16,000; £15,000 (against £20,000) is placed to reserve; and a final dividend of 5 per cent. is being paid on the ordinary shares, again making 10 per cent. for the year; a balance of £19,776 is carried forward.

Great Northern Telegraph Co., Ltd., of Denmark.

The directors propose to pay a total dividend and bonus of 20 per cent., including the five per cent. already paid, for the year 1929, and to transfer £33,333 to the reserve and renewal fund, while £38,889 will be allotted to the pension fund. It is further proposed to carry forward £229,923, and to increase the amount by £83,893 which appears in last year's balance sheet under the item "Reserved for taxes."

Einstein's Electro Chemical Process, Ltd.

The first report, covering the period ended December 31st last, shows a debit balance of £21,553. It is explained that this is due to the fact that the period was one of development only, not of commercial production. The company's factory at Slough was only in partial operation at December 31st last owing to delays in the delivery of special plant; it is now in working order.

G. D. Peters & Co., Ltd.

The profit for 1929, after taking into account the results of all subsidiary companies, was £8,834 (against £8,228 in 1928). To this is added £12,992 brought forward, and after placing £957 to reserve for income tax and appropriating £6,245 for interest, £14,624 is carried forward. No dividend on the 6 per cent. preference shares has been paid since June 30th, 1925.

Calcutta Electric Supply Corporation, Ltd.

The directors recommend a final dividend on the ordinary shares of 7 per cent. (actual) for the half year ended December 31st, 1929, making 12 per cent. (actual) for the year, also a cash bonus of 5d. per ordinary share, both less tax at the rate of 2s. in the £.

American Telephone and Telegraph Co.

The company has announced another bonus for stockholders in the form of an offer of one new share at $100, or par, for each six shares held on May 23rd. On the basis of approximately 13,500,000 shares now outstanding, the rights valued at about $24.50, each will mean the issue of about $235,000,000 worth of new stock. The aggregate value of the rights, which expire on August 1st, is about $327,000,000. The capital thus raised will be used by the company for the 1930 expansion programme of the Bell Telephone System.—*Reuter* (New York).

Stocks and Shares.

Tuesday Evening.

Stock Exchange markets picked up the threads of business, after the holiday, in a somewhat hesitating manner. The dismal weather which prevailed in London and in certain other parts of the country was regarded as being unfavourable to such enterprises as are usually affected by conditions of the climate. The Budget, which at first caused a sharp fall in gilt-edged stocks, is losing its force as an influence of depression. A brisk rise in War Loan helped to strengthen prices of other gilt-edged securities. Central Electricity Board 5 per cent. stock is steady at 99¼, and the partly-paid scrip at 1¾ premium. North-West Midland Electricity 5 per cent. scrip remains at 99½, which, by the way, is the issue price. North Metropolitan Electric 5½ per cent. debenture stock, which came out at 100, is up to 5½ premium. No little curiosity is felt at what may be the developments in regard to a very ambitious scheme for supplying power from a point on the East Coast of Africa, up to Tanganyika. The Power Securities Corporation is the sponsor of the projected plan.

Cables and Wireless.

No little disappointment is felt at the continuance of the weakness in Cables and Wireless issues. All three classes of stock have gone back. In the "B" ordinary stock, business has been marked as low as 27, and in the "A" ordinary, business is officially recorded down to 53¾. The nominal middle prices of the stocks are 29 and 56½, respectively. The 5½ per cent. preference has changed hands at 95. It cannot be denied that the confidence of the proprietors of Cables and Wireless stocks is severely shaken, the first blow having been struck by the revelation of the Post Office attitude. The dividend announcement on the "A" ordinary stock is expected to be declared in June or July, and it is awaited without enthusiasm. Globe Telegraph and Trust ordinary shares have gone back to 21¼, showing a fall of 10s. International Telephone and Telegraph at 73½ is a point to the good, American Telephone and Telegraph at 260 is 20 points down; the company announces a fresh issue of stock, at 100, in the ratio of one new share for each six shares owned. The American Telephone and Telegraph expects to spend 47 million pounds sterling this year in improvements and additions. This will form part of the 140 million pounds sterling which is to be spent by the telephone systems of America during 1930.

County of London Electric.

County of London Electric Supply ordinary shares hardened to 48s. on the speech of Sir Harry Renwick, read at the meeting last week. The new shares at 9s. 1¼d. premium are the turn better. The chairman and managing director of the County Company abates nor jot nor tittle of his optimism in regard to the outlook for the whole industry in general, and for the County Company in particular. Previous speeches of Sir Henry Renwick have sounded almost too exuberantly hopeful, but the candid critic is forced to admit that their cheeriness has been justified abundantly. This experience of the past gives ground for faith in what Sir Harry prophesies as to the future.

Home Electricity Supply.

London Electric ordinary shares have advanced to 30s., and Charing Cross ordinary to 27s. 6d. South London Electrics are firm at the latter price. The company's report shows all-round improvement. Profits are £9,000 better at £124,400; units sold increased by more than three millions; the carry-forward of £98,800 is £3,500 up. The dividend is maintained at 8¼ per cent. for the year. The South Metropolitan Electric Light and Power Company also shows good progress in its annual report. The dividend, making 9 per cent. for the year, is ¼ per cent. better than was that for 1928. Sales of units are seven millions up, at 46,400,000. Most of the ordinary shares are held by the County of London Electric; the 7 per cent. first preference are quoted at 26s. 3d., the 6 per cent. second preference at 21s. 9d., and the 4½ per cent. redeemable first debenture stock at 96. Notting Hill ordinary shares have been inquired for on the basis of £7 10s. The nominal value of the shares is one shilling each.

Amongst provincial electric lighting shares, Newcastle-on-Tyne ordinary are a few pence easier at 24s. 6d. On Scottish Power new shares, with the issue of which the company achieved remarkable success last week, a premium of 1s. per share is established. The senior shares are unchanged at 29s. British Power and Light at 14s. 6d. show a slight improvement. Of other issues, Victoria Falls found buyers up to 62s. 6d. Atlas ordinary are a trifle firmer at 28s. 4½d.

Indian Electrics.

Continued unsettlement in India tends to make for dulness in the price of Indian industrials. Calcutta Electric Supply ordinary are 49s. 6d. The company has declared a dividend of 7 per cent., making 12 per cent. for the year, plus a cash bonus of 5d. per share. The dividend is the same as that of a year ago, but the bonus is a penny more. The 5 per cent.

tax-free preference are hard at 20s., the increases in income-tax and surtax having a beneficial effect upon "tax-free" shares of all kinds. Delhi Electric Supply and Traction shares are quoted at 35s. middle; Cawnpore Electric Supply ordinary at 28s. 9d.; Madras Electric ordinary at 27s. 6d. Of the prior-charge stocks, Tata Power 7½ per cent. "B" debenture stock is about 97. The company's 4½ per cent. "A" debenture comes into the group of Trades Facilities Acts stocks, guaranteed by the British Government, and the price is 94½ ex the dividend due on the 15th of next month. Andhra Valley Power Supply 7½ per cent. ten year secured sterling notes, the market in which is usually somewhat restricted, are 97 middle. Calcutta Tramways ordinary changed hands a few days ago at 12s. 9d., and the 5 per cent. preference at 12s. 6d. The 4½ per cent. debenture is 68½, and the 7 per cent. second debentures, with six months' interest due next month, are 96½. Madras Electric Tramways 6 per cent. preference, the dividend upon which was duly paid, are 10s. xd.

The Irishman's Rise.

In last week's article on Stocks and Shares (Electrical Review, p. 745), it stood gravely recorded that "Mexico Tramway shares rose 3½ to 33½, but reacted to 300." Midshipman Easy's nurse excused her baby on the ground of its being only a little one; similarly, the Mexico mistake may be dismissed, at all events by the charitable, as a thing of nought.

Home Railways.

Following the Budget, there came a gain of 3 points, to 112, in Underground Electric Railway incomes. The shares rose 6d. to 23s. 6d. This reflected the relief felt at the absence of any fresh tax being imposed upon petrol. Metropolitan Consolidated rose 10s. to 65½, and Districts were left at 77½. London Electric ordinary stock changed hands, on the eve of the holiday, at 73¾. The "money" stocks in this department have held their recent gains. The Southern Railway's new 5 per cent. preference stock, issued to extend the company's electrification programme, is now being dealt in at a small premium. The opening price on Tuesday morning was about ⅜ premium, but evidently the issue was heavily stagged, for stock came to market, and the price gave way to ⅛ premium.

Tramway stocks and shares are mainly unchanged. British Electric Traction deferred has risen 50, to 1675.

Manufacturing Companies' Shares.

Few changes of consequence have occurred in the list of shares in companies included in the manufacturing and equipment group. Associated Electrical Industries shares are unaltered, at 28s. The profit is considered ample to justify the directors in declaring the same rate of dividend as that distributed in 1928 (6 per cent.), before the amalgamation became complete. It is noteworthy that as the company pays the dividend on its ordinary and preference shares only once a year, the present dividends are subject to the new tax of 4s. 6d. in the £. Henley's are better at 6⅜, and the rest of the shares in this section hold their previous prices. English Electric ordinary remain at 3s. 9d., the preference at 7s. 6d., the market being unaffected by last week's meeting, at which the chairman stated there had been a definite improvement in efficiency. This, he said, had gone far to counteract the drop in prices, to which latter cause had to be attributed the less favourable results of the year's trading as compared with those of the previous twelve months. The giant Babcock and Wilcox Company published its figures on the eve of the holiday. The dividend is repeated at 15 per cent., free of tax. The trading profit of £676,000 is £116,000 down, but the actual amount available is no more than £76,000 lower than it was a year ago, owing, this time, to an exceptional accumulation of uncompleted orders. The directors have decided to place £48,000 to reserve, bringing the fund up to £900,000. G.E.C. ordinary receded to 49s. 6d., but, on the other hand, the company's preference shares are better, the 6½ per cents. at 23s. 6d., and the 7½ per cent. "B" preference, at 26s., both being up on the week. Ever-Ready shares are 20s. 6d. A rise to 127½ in Brush ordinary is the first alteration that the price has undergone for several weeks, if not months. Probably the imminent approach of the dividend has served to attract attention to the stock.

"Dollar" Stocks.

Considerable irregularity developed amongst the stocks and shares of which New York has recently been so bullish. Canadian General Electrics hold the rise of 65 points which they have gained this month; Brazilian Tractions, at 53½, are 1½ better; Montreal Light & Power, at 162½, is 2½ up; Pennsylvania Power shares, after being better, gave way to 90. Hydro-Electrics have been moving with violent fluctuations, and at 53 are 1½ down. International Holdings, following Hydro-Electrics, at 7¼, are ¾ lower. In the Mexican group, Mexican Light & Power preferred shares gained 2 at 72½, and the 5 per cent. first mortgage bonds, at 79, are similarly better. The company's second mortgage bonds, at 72, show a small gain. Yet the common shares, at 86½, are 6 down. The American statistics of rubber consumption are below expectations, and the rubber share market is dull in consequence.

Share List of Electrical Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price April 22 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	3½	—	4 16 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary	1	8½	8½	27/6	+6d.	5 1 10
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¼	8¼	26/-	—	5 7 8
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—	4 6 6
County of London	1	7	10	45/-	+6d.	4 3 4
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-	—	4 13 7
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	8½	9	30/-	+1/6	4 13 4
Metropolitan	1	9	10	41/3	—	4 17 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	7	29/-	—	4 16 7
Mid. Elec. Power	1	15	8	31/3	—	5 2 3
Newcastle-on-Tyne Ordinary ...	1	6	6	24/6	—6d.	4 18 0
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	23/6	—	5 5 9
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	29/-	—	5 3 3
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	33/9	—	4 2 10
Westminster Ordinary	1	8½	8½	26/6	—	5 5 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	33/9	—	4 14 8
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	77	—	5 4 0
Metropolitan	„	3½	4	65½	+½	6 2 2
do. District	„	4	5	77½	—	5 3 0
Underground Electric	£1	7	8	23/6	+6d.	6 16 2
do. do. Income ...	Bonds	6	6	112	+3	5 7 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	„	1½	1½	24⅞	—	6 0 7
Automatic Telephone	1	10	12½	87/6	—	5 13 4
Cables & Wireless 5½ Pref.	Stock	—	5½	96⅜	—1	5 14 0
do. A 7½ Ord.	„	—	—	56½	—1	... ...
do. B Ord.	„	—	—	29	—1	... ...
Globe Tel. and T. Ord.	10	10	10	21½	—½	*4 13 0
do. do. Pref. ...	10	6	6	11¾	—	5 9 1
Great Northern Tel.	10	20	20	32½	—	6 3 0
Marconi-Marine	1	12½	15	2⅞	—⅛	7 5 2
Oriental Telephone Ord	1	12	12	55/6	—	*4 6 6
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8	—	9 3 4
do. do. 2nd Pref. ...	5	6	6	8⅛	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	71½	+1	7 0 0
British Electric Traction Def. Ord.	„	5	5	1675	+50	... ...
do. do. Pref. Ord.	„	8	8	126½	—	6 6 6
Brazil Traction	100	7	8	53½	+1½	3 14 9
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	93½	—	5 8 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	59½	—	7 12 4
Mexico Trams, 6% Bonds	—	5	5	70	—	7 2 10
Mexican Light Common	100	Nil	Nil	86½	—6	... ...
do. 7% Pref.	100	7	7	78½	+2	8 18 4
do. 1st Bonds	—	5	5	79	+2	6 6 7
Victoria Falls Ord.	1	15	15	32/-	+9d.	4 16 10
Yorkshire (West Riding)		Nil	Nil	5/-	+9d.	... ...
Manufacturing Companies.						
Assoc. Elec. Ord.	1	6	—	28/-	—	4 5 9
Babcock & Wilcox	1	15	15	3½	—	*4 16 0
British Aluminium Ord.	1	10	10	45/9	—	4 7 2
British Elec. Transformer Pref. ...	1	7	7	10/-	—	... ...
British Insulated Ord.	1	15	15	3½	—	9 17 6
Brush Ord.	Stock	10	10	127½	—	7 17 0
Callenders	1	15	15	3½	—	4 0 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Ord.	£/-	—	80	22/6	—	6 13 4
do. 8% Pref.	1	8	8	24/6	—	6 10 6
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	6½	11/3	—	9 15 6
Enfield Cable Ord.	1	20	20	4½	—	4 9 0
English Electric	1	Nil	Nil	3/9	—	... ...
do. do. Pref.	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	23/6	+6d.	5 10 7
do. Ord.	1	10	10	49/6	—2/-	4 0 8
Henley...	1	25	30	2⅜	+⅛	4 10 8
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	10/9	—	... ...
Johnson & Phillips	1	10	—	2	—	6 0 0
Siemens Ord.	1	7½	7½	25/-	—	6 0 0
Telegraph Construction	12	10	10	22½	—	*5 6 8

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during March.

ALTHOUGH during last month our electrical export total fell below the February figure it was more than £230,000 above the total for March, 1929, and thus raised the exports for the first quarter of this year to £554,051 above the corresponding figure for 1929. Comparing the details with those for February, wide variations are seen. The "goods and apparatus" section, owing mainly to a rise in unenumerated goods, was higher, in spite of a fall of about £28,000 in cable exports. An increase of £28,000 in "other motors and generators" was overweighted by decreases in the other two items of the machinery section, bringing the total for that section £13,000 below the February figure. As a whole the telegraph and telephone section suffered a substantial decline (£64,765), but this was due to a large fall in exports of submarine cable, an item subject to violent fluctuations. The decrease in exports of instruments and apparatus was considerable. Against the March, 1929, figures practically all items showed an increase. The principal rise occurred in the case of insulated wires and cables, while exports of "other motors and generators" increased by nearly as much. The machinery group showed a net advance of £85,392, but the telegraph and telephone instrument section fell, as a whole, by £26,490.

The import section shows that purchases of electrical goods from abroad are being maintained at a higher level than in the preceding year. In spite of a fall of £12,749 in the total, as compared with February, the figure was £211,155 above that of March last year. The most notable feature is the enormous increase in imports of meters and instruments which is almost wholly responsible for the advance in the total. Although cable imports were lower than in February they were well above the March, 1929, level. Conversely, while the value of telegraph and telephone apparatus rose above the February figure, it was below that for the corresponding month of last year.

Re-exports during March receded sharply from the abnormally high level reached in the previous month, although they remained well above the total for March, 1929. The slump was due principally to falls in shipments of telegraph and telephone apparatus, and batteries and accumulators.

The inset table shows the distribution of our electrical machinery exports during March by weight and value, and compares the figures with those for the corresponding month of last year. From this it will be observed that India gave place to Australia as the leading customer, the "turnover" being in the neighbourhood of £120,000. South Africa's share increased to a very satisfactory extent, being more than doubled, while that of European countries also showed a continuance of the rise which has characterised recent months. Perhaps of even greater significance is the advance which took place in the case of Canada.

Destination.	Quantities.			Values.		
	March, 1929. Tons.	March, 1930. Tons.	Inc. or dec. Tons.	March, 1929. £	March, 1930. £	Inc. or dec. £
Europe	293	475	+182	68,563	95,220	+26,657
Japan	24	7	− 17	7,911	2,806	− 5,105
South America ...	321	306	− 15	48,160	50,937	+ 2,777
South Africa ...	175	465	+290	29,619	65,996	+36,377
British India ...	1,173	535	−638	162,466	102,605	−59,861
Australia	427	944	+517	73,215	124,549	+51,334
New Zealand ...	157	253	+ 96	20,430	38,841	+18,411
Canada	95	219	+124	13,319	24,681	+11,362
Other countries ...	401	483	+ 82	62,572	66,012	+ 3,440
Totals ...	3,066	3,687	+621	£486,255	£571,647	+£85,392

	Exports.			Imports.			Re-Exports.		
	Electrical exports for March, 1930.	Inc. or dec. as compared with Feb., 1930.	Inc. or dec. as compared with March, 1929.	Electrical imports for March, 1930.	Inc. or dec. as compared with Feb., 1930.	Inc. or dec. as compared with March, 1929.	Electrical re-exports for March, 1930.	Inc. or dec. as compared with Feb., 1930.	Inc. or dec. as compared with March, 1929.
Electrical goods and apparatus (unenumerated)	£315,608	+£48,327	+ £68,660	£144,533	+ £919	+ £19,976	£9,423	−£1,157	+£2,012
Insulated wires and cables ...	305,168	− 27,975	+ 76,726	72,375	− 22,743	+ 12,928	349	− 327	− 385
Glow lamps	42,304	+ 262	+ 2,656	26,871	− 9,169	− 22,230	2,507	+ 1,014	+ 1,519
Arc lamps and parts	1,015	− 3,807	+ 384	2,018	− 1,192	+ 1,217	—	− 2	− 2
Batteries and accumulators ...	83,765	− 2,843	+ 6,575	46,375	− 5,523	+ 1,587	818	− 18,111	+ 716
Meters and instruments ...	35,037	+ 8,442	+ 8,988	215,230	− 8,203	+ 192,303	1,466	+ 677	+ 694
Carbons	158	− 50	—	24,041	+ 8,480	+ 5,456	904	+ 94	+ 888
Switchboards (not telegraph or telephone)	13,042	+ 3,085	+ 7,411	242	+ 118	+ 85	—	− 10	—
Electrical Machinery—									
Electrical machinery (unenumerated)	339,498	− 27,399	+ 45,901	159,452	+ 6,550	+ 9,649	8,979	− 2,218	+ 2,774
Railway and tramway motors	17,134	− 13,863	− 35,277	—	—	—	—	—	—
Other motors and generators...	215,015	+ 28,215	+ 74,768	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	70,439	+ 13,317	+ 29,914	1,657	− 1,879	− 1,874	42	+ 42	+ 42
Submarine telegraph and telephone cable...	10,635	− 36,500	+ 8,021	—	—	—	—	—	− 4
Telegraph and telephone instruments and apparatus ...	154,175	− 41,582	− 64,425	90,355	+ 19,893	− 7,942	18,156	− 50,818	+ 15,616
Totals	£1,602,993	−£52,371	+ £230,302	£783,179	− £12,749	+£211,155	£42,644	−£70,816	+£23,870
Increases for first three months of 1930.			Exports £554,051			Imports £822,400			Re-Exports £127,936

The Argentine Electrical Market.

Official Views on British Representation.

Mr. E. J. JOINT, who, in the absence in England of Mr. Chalkley, is acting as Commercial Counsellor at Buenos Aires, has this year written the report on economic conditions in the Argentine Republic, published for the Department of Overseas Trade by the Stationery Office, price 3s. 6d. net. It should be read in conjunction with the recently-issued report of the British Economic Mission, a summary of which appeared in our issue of March 21st (p. 558). In it there is further evidence that British manufacturers and exporters are not improving their footing in the Republic as they should, having regard to the willingness of the Argentines to buy British goods, and to the purchases of the vast British capitalised enterprises established in the country. With regard to the shares of the various competing countries in Argentine import trade in 1928, the percentage of the United Kingdom was 20, and that of the United States 25, in both cases about the same as in the previous two years; while Germany's percentage was 12, about the same as during the previous four years. Compared with 1924, however, the share of the United Kingdom showed a decline and that of the United States a distinct advance.

In referring to the large orders for constructional materials placed by the British railway companies operating in Argentina, the report mentions that the electrification of the existing steam line from Retiro *via* Villa Ballester to Tigre, on the Central Argentine Railway, has been approved and that work has been started on the necessary power stations. The report proceeds to examine in some detail the market for electrical plant and materials, with particular reference to the acquisition by foreign interests of numbers of large and small power plants. Two groups associated with American capital appear now to control about 180 plants in the Republic. It is so far satisfactory to learn that the policy of the new owners is to buy in the most economical market without preference as to country of origin. It is, however, expected that the usual practice with regard to plant extensions and future replacements will be to purchase from American connections wherever possible. It is foreseen that business possibly lost in this way to British firms may well be counterbalanced by a general increase in the use of electrical devices.

The Sale of Electrical Products.

It is pointed out that although British standard electrical practice does not conform to either American or German standards, the quality supplied by American firms is more in line with that of British products and that in the long run the quality of the goods in public demand may be raised. Elsewhere, however, it is emphasised that at present the Argentine market is one which prefers cheapness to quality. This applies notably to wires and cables, the higher qualities of which are sold by British firms solely by personal effort coupled with a long experience of the trading methods of the country. The British share, apart from the purchases of the British-owned railways, represents only a small proportion of the total business done, and a ready sale exists for low-grade material at prices with which British manufacturers cannot compete. Some of the better architects are insisting on British specifications, but as a rule they still leave the contractor a free hand.

Electric lighting sets are, in Mr. Joint's opinion, a difficult line for British manufacturers, as although competition may be possible as regards the engine, the electrical equipment often has to be of foreign manufacture in order to secure a sale. The demand shows little increase now owing to the constant extension of large electric power plants.

A good market exists for electric refrigerators for domestic use. The demand for these machines is steadily increasing, and in many instances they are regarded as normal equipment in the construction of new buildings. At present American manufacturers obtain a considerable part of the trade, but the British share is important and increasing. The larger market, as yet untouched, is for an inexpensive machine to compete with the ordinary ice-box.

Radio Apparatus.

The market for radio apparatus, the report continues, is almost entirely controlled by American manufacturers, and British firms have so far shown little interest in the business. Broadcasting conditions locally are in such a confused state that only highly-selective sets find a sale. These conditions are comparable with those existing in the United States, but in contrast with English broadcasting, and therefore the sets produced by American manufacturers are of a more suitable type for Argentina. If British sets were available with selectivity and range at a competitive price, sales could be considerably developed. Some trade has been done in imported components for use by local manufacturers and important orders have been secured by British manufacturers. Local production has, however, been affected recently by a drop in the price of American apparatus with a consequent falling off in demand for components. This decline is regarded as temporary and prospects for materials for local assembly remain good. British loud-speakers have a good reputation and a steady sale. In valves Dutch and American manufacturers have the bulk of the trade owing to their extensive advertising methods, but some special types of British valves find a market. British apparatus in general is able to compete in price with the material coming from other countries, and with more attention to the special types required locally, and to advertising, a larger business might be secured by the United Kingdom.

Representation in the Republic.

Mr. Joint proffers some interesting advice on the subject of representation, pointing out that every year an increasing number of foreign manufacturers open their own branches in Argentina. In his opinion British firms should closely watch the results of this development with a view to deciding when such a step is likely to give sufficiently increased returns to warrant the necessary capital outlay. He says that experience in the recent past has gone to show that this matter is one which depends on so many varying considerations that careful study is necessary before a decision is taken. Often a firm which has worked through old-established local agents becomes so closely connected with the latter in the public mind that the opening of a separate establishment would seriously affect the goodwill. On the other hand, there are many businesses which have outgrown the capacity of the local agents and need a stronger organisation for their proper development. In those lines where technical service is required, where extensive advertising has to be done, or where large showrooms are an advantage, the establishment of a local branch may often be the only method of properly developing the trade.

The bulk of the business in British manufactures is done through resident agents. It is essential that the agent should enjoy the fullest confidence of the manufacturer. The latter should give due consideration to the advice of his agent, and should endeavour to meet his wishes as regards advertising, presentation of samples, and similar matters. To have sufficient confidence to be able to do this, however, it is essential that the local representative should be a man of integrity and responsibility. A bad agent may do in a short time more damage to a firm's reputation than can ever be fully recovered, while a paying line, if properly handled, may be entirely neglected owing to the agent's other commitments.

It may be added that at the British Empire Trade Exhibition to be held next year there will be sections covering electrical equipment, heavy machinery, household machinery, factory plant, and railway and tramway materials.

Indian Electrical Notes.

[From our Indian Correspondent.]

The Mandi Scheme.

THE Committee appointed some time ago to inquire into the Mandi Hydro-Electric Scheme in the Punjab has now submitted its report. The Committee states that the supply of energy from the Mandi works should begin not later than the end of July, 1933, and the total capital cost up to the date of starting the work should not exceed Rs. 625 lakhs. The flow of the Uhl River upon which the Mandi works depend is estimated at one hundred cusecs. The plant should be loaded up by the tenth year of operation; the demand for energy by the twelfth year should be 40,000 kW. It is considered premature to fix the tariff at this stage in view of the high expenses and large commitments already entered into and the financial prospects. The Committee does not recommend abandonment of the scheme, but before any extension of the second stage of the scheme is undertaken it is considered that the Government should appoint an expert Committee to examine the merits of the different schemes.

Reductions in the present establishment and the "Indianisation" of the higher services in the hydro-electric department are also recommended by the Committee. If the Government agrees to give the work of distribution to private companies, it is recommended that preference should be given to Indian firms. It it estimated that when the Mandi scheme can supply energy for domestic consumption as well as for industry, it will be available in abundance at very cheap rates, less than one-third of those at present charged by private companies. So far more than Rs. 3 crores has been spent by the Government on this scheme.

The Pykara Scheme.

At a recent meeting of the Madras Legislative Council, full details regarding the Pykara Scheme and its immediate developments were placed on the table when sanction to grants for this were asked for. The expenditure which is likely to be incurred in the coming three years will be approximately Rs. 35, 55 and 25 lakhs, respectively, which with the addition of the expenditure so far incurred on the Glen Morgan Scheme

and the amount sanctioned for Pykara for this year will bring the total to Rs. 126 lakhs. The scheme will generate up to a maximum of 21,000 h.p. at the first stage. The demand for power is expected to increase rapidly and the second stage will be taken up before the tenth year. At the end of the first year of operation, the load on the power plant is estimated to be 3,290 kW. By the tenth year all the principal users of power, the mills, the tea estates, the South Indian Railway, &c., will begin to utilise electrical energy.

The rates at which power is to be sold are such as will prove an incentive to the present users of oil and steam power to change over to electric drive. A scheme has also been drawn up for granting loans to such users as require aid in converting to electricity. Adequate safeguards are provided to ensure the lowest possible rates for the smallest consumer. The day should not be far off, in the opinion of the Government, when large supplies of power in bulk will be sold at less than a third of an anna per kWh and the small householder need pay only an anna and a half per kWh for what he uses.

Bombay Telephones.

Mr. Bunbury presiding at the annual general meeting of the Bombay Telephone Company stated that the net profit for past year was Rs. 13,87,000 showing an increase of more than a lakh over the previous year's profit. After providing proper depreciation a dividend of 6 per cent. was declared. The company is gradually introducing a new type of automatic call office in place of the old manual type hitherto used. Two of these have already been installed and are working satisfactorily. The company's policy is to house these exchanges in its own buildings. The company is also purchasing a new exchange in Ahmedabad. New exchanges are being built in Salsette at Andheri and Ghatkopar. In addition to this capital programme, the company continues the policy of gradually replacing overhead wires by underground cable. The same policy is being followed in Ahmedabad and this should lead to a decrease in the cost of maintenance and an increase in the efficiency of service. At the present time, the company owns approximately 69,000 miles of underground wire and 4,600 miles of overhead wire. The whole of the capital programme involves an expenditure of about 16¼ lakhs, of which 7 lakhs has already been expended.

Telephone Development in India.

In 1928-29, the total number of telephone lines in India including extensions owned by the Government, licensed companies, and others, but excluding the Native States, was approximately 54,000, operated through 310 exchanges. Of this total 19,935 lines and 288 exchanges were owned and maintained by the Government, and 33,750 lines and 22 exchanges were owned and maintained by licensed companies with 345 independent non-exchange systems having 954 telephones. The Government revenue including trunk call fees amounted to 48.87 lakhs, as compared with 44.56 lakhs for the previous year, showing an increase of 4.31 lakhs, or 9.4 per cent.

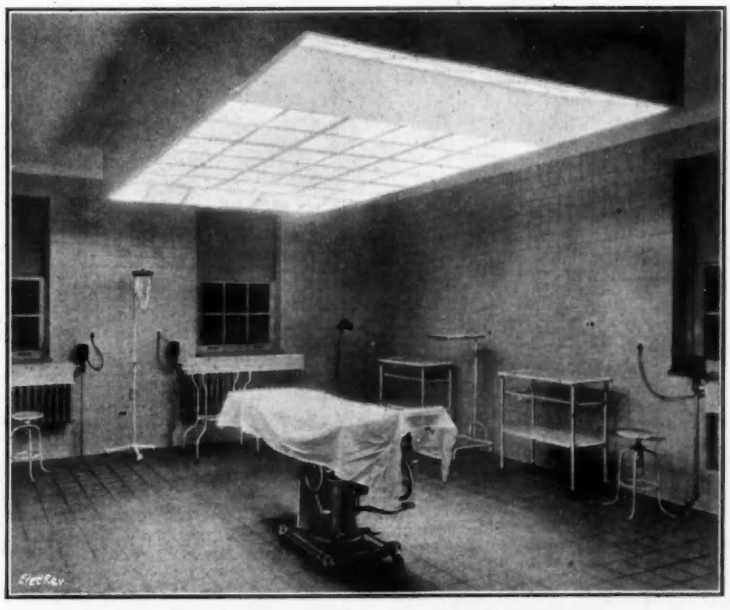
The licensed companies' revenues totalled 73.84 lakhs as against 68 lakhs, showing an increase of 5.83 lakhs, or 8½ per cent. It has been calculated that there is now one telephone per 4,600 inhabitants. A more efficient system of long-distance calling would result in a much greater use of this means of communication by the public. There are already proposals for linking up India with Europe by radio-telephone, and when this comes to pass it would detract considerably from the value of such a measure if the internal systems were not brought up-to-date and in line with the external overseas communications.

Hospital Operating-table Lighting.

Notes on the Equipment Recently Introduced by Holophane, Ltd.

HOSPITAL operating-table lighting calls for a very high intensity of concentrated illumination which must be practically shadowless, but which must give a high vertical component of intensity, ensuring penetration into deep cavities. The super-intensity must be confined to the wound area, but at the same time sufficient illumination must be given around the room to prevent eye-adaption difficulties, and yet not so much as to compete with the wound illumination. The high intensity should be produced without striations or glare, and the light unit should be as unobtrusive as possible. To fulfil these specific conditions, a special unit has been developed by Holophane, Ltd., consisting of a number of prismatic plates formed into a panel or false ceiling of relatively large area. The prism construction of the plates is such as to refract the light rays which reach them into a converging beam of high intensity. Each plate is 12 in. square, and is formed with quarter-concentric prisms. They are used in groups of four, each group forming one large lens 24¼ in. square, having a 12¼-in. focus. The complete units consist of either 15 groups of 4 plates, overall dimensions 10 ft. by 6 ft.; 18 groups, 12 ft. by 6 ft.; or 21 groups, 14 ft. by 6 ft. Over each group is fitted a lamp and reflector in such relation to each other that the maximum beam strikes the centre of the operating area. With a 15-group system the combined 15 concentrating beams, coming from different directions, build up and focus their rays over the predetermined area.

The method employed differs from a reflector system insomuch that concentration from the large refracting area secures adequate diffusion, avoids harmful shadows, and absolutely avoids glare. The overflow from the lens system gives sufficient general illumination to avoid contrast glare, and the optical characteristics of the lens are such that a three-dimensional soft or dissolving spot is developed to take account of varying thicknesses of bodies and heights of tables. The results obtained from a 15-lens system employing fifteen 150-watt lamps are a maximum horizontal illumination of 1,050 ft.-candles, an illumination on a plane 45 deg. from the vertical of 725 ft.-candles, and an illumination on a vertical plane facing the centre of the table of 175 ft.-candles; these high intensities are unaccompanied by any semblance of glare.



"Holophane" Operating-table Lighting Outfit.

The smooth sides of the plates are fixed towards the light source. As the complete unit is totally enclosed and forms the ceiling of the operating theatre, there can be no collection of dust particles and no obstruction projecting into the theatre.

An outfit such as that described is at present being displayed in the special demonstration room at "Holophane House."

The Central Electricity Board.

Extracts from the Second Annual Report.

(*Concluded from page 757.*)

In South-East England the first of the Board's lines in any area was put into commercial service in the spring of 1929, *viz.*, a 10-mile section of 132-kV line between Bedford and Little Barford (in temporary use at 33 kV).

Recently 33-kV lines have been put into commission between Croydon and Epsom, Luton and Aylesbury, and Brighton and Worthing. The Brighton-Worthing line is the first high-power

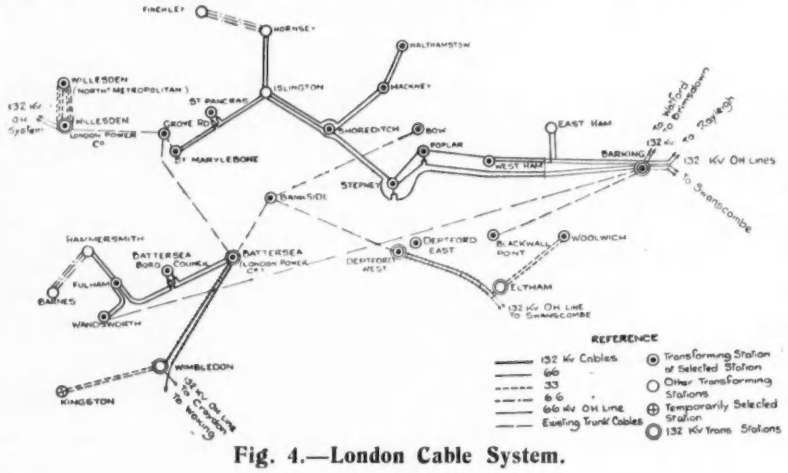


Fig. 4.—London Cable System.

line in this country to be carried on spun reinforced concrete supports, but the other lines are carried on narrow-base steel towers. This area is specially noteworthy because of the large amount of underground cable required in London itself (fig. 4). During last December the first section of the cable system (between St. Pancras and Hornsey) was put into service. Jointing operations are illustrated in fig. 5.

Negotiations are well advanced for a crossing of the Thames to the east of Barking which will necessitate a main span of 3,000 ft. and towers on either side over 500 ft. high, as the minimum high water clearance must be 250 ft.

During the year construction work has been proceeding on 14 transforming stations.

For Central England all the main contracts have been placed, and construction work has commenced on the primary line between the two Birmingham stations (Hams Hall and Nechells) and Ocker Hill. In Central England painted copper-bearing steel is being used for the construction of the towers with a view to comparing the anti-corrosive properties of this combination with those of the galvanised steel being used generally for tower construction for the other schemes. A 33-kV line, 14 miles in length, between Northampton and Kettering was put into service in February of this year.

For North-West England and North Wales also the main contracts have been placed. A 33-kV line between Stockport and Macclesfield was put into commission on September 30th last.

A departure from the general standard of 132-kV construction will be made for the approach to Clarence Dock sub-station, Liverpool, where the lines will be run on gantries over the Liverpool-Leeds Canal.

For Mid-East England contracts have been placed for the overhead lines, and satisfactory progress has been made in other respects.

Temporary Arrangements.—The Board has entered into temporary arrangements with individual undertakers who require additional supplies before the grid supply becomes available, so that uneconomical expenditure on the extension of small stations may be avoided.

The arrangements made, or under discussion, include the giving of supplies to the Greenock Corporation; Ayrshire Electricity Board; Falkirk, Kirkcaldy, and Paisley Corporations; North Metropolitan Electric Power Supply Co.; London and Home Counties J.E.A. (Barnes U.D.C., Finchley U.D.C., Islington Borough Council, Leatherhead and District Electricity Co., and Reigate Corporation); Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co.; Central Sussex Electricity, Limited; Hastings Corporation; Aldershot Gas, Water, and District Lighting Company; Kettering U.D.C.; Alderley Edge and Wilmslow Electricity Board; Lancashire Electric Power Co.; Fleetwood U.D.C.; Bridlington Corporation, and the undertakers for the Lincolnshire Special Order.

Change of Frequency.—Standardisation of frequency is proceeding in Central Scotland, Central England and North-West England. Motors aggregating 29,509 h.p. and rotary convertors of 21,405 kW capacity have already been changed.

Finance.—Up to December 31st, 1929, the Commissioners had issued consents to the borrowing by the Board of a sum not exceeding £12,500,000 for the construction of main transmission lines and preliminary expenses, and £5,400,000 for frequency standardisation. The total amount that the Board is empowered to borrow is £33,500,000. To meet expenses during the initial period the Board obtained temporary advances from the Bank of England. In May, 1929, it made an issue of £3,000,000 Central Electricity 4 per cent. stock at the price of £83 per cent.; £600,000 of this sum has been allocated to frequency standardisation. In January, 1930, the Board issued £7,000,000 Central Electricity 5 per cent. stock at the price of £97 10s. per cent.

The Commissioners, in giving sanction to the Board to borrow, prescribe the period within which provision must be made for repayment. In respect of money borrowed for the purpose of the standardisation of frequency the period prescribed is 40 years; in respect of borrowing for other purposes various periods are fixed for the respective classes of expenditure, *e.g.*, freehold land, 60 years; buildings, 30 years; overhead lines, 25 years; underground mains, 40 years; plant and machinery, 20 years.

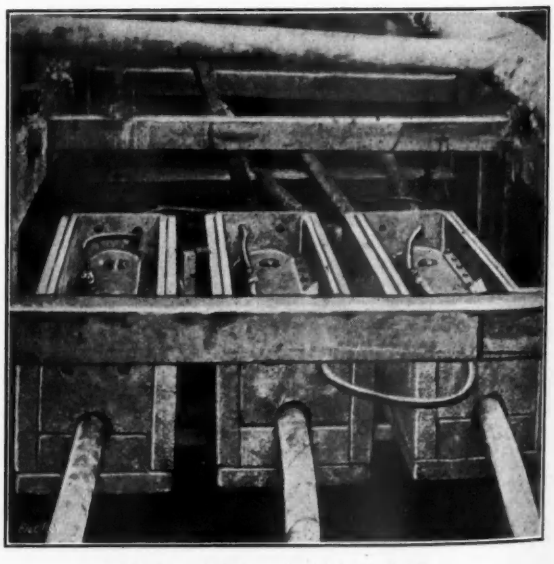


Fig. 5.—Joints of 66-kV Cables.

The provision for the redemption of money borrowed for purposes other than the standardisation of frequency and the discount on issue corresponding therewith has been suspended, with the consent of the Electricity Commissioners after consultation with H.M. Treasury, for five years unless the expenditure becomes remunerative at an earlier date.

Appendix.—The appendix includes four maps of the schemes considered during the year, and of the grid as a whole, and 33 photographs and diagrams of the lines and sub-stations actually constructed, &c.

The figures illustrating this article are reproduced by permission of the Central Electricity Board.

Swiss Railway Electrification.

Some notes on the Oerlikon combined rack-rail and adhesion electric locomotives used on the Viege-Zermatt mountain railway.

(COMMUNICATED.)

THERE are several interesting aspects of the recent completion of the electrification of the Viege-Zermatt railway in Switzerland. It was at first planned to use motor coaches operated by d.c. at 2,000 or 3,000 V, but it was later decided to use locomotives capable of hauling a trailing load of 60 tons. Of the various schemes submitted, that of the Oerlikon Co. for the supply of five combined rack and adhesion engines was accepted.

The traction system, which has not previously been used on rack railways, is single-phase a.c. at 10,500 V at the feeding point, the necessary power being drawn from the Swiss Federal Railway transmission mains through a step-down transformer station.

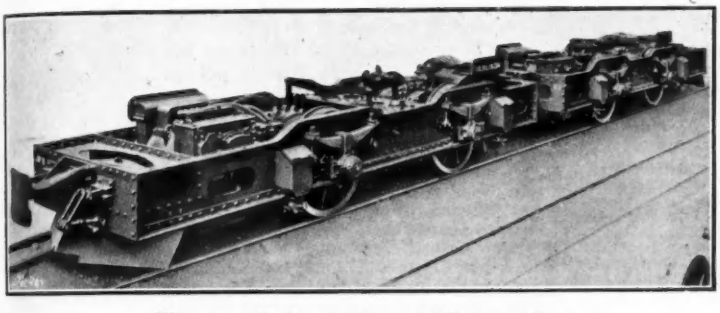


Fig. 1.—Under-carriage of Locomotive.

The line is of one-metre gauge and 21¾ miles in length, the difference in altitude between Zermatt and Viege being 3,131 ft. The length of the adhesion sections of the line is 17.15 miles, and that of the rack sections 4.62 miles. The rack system, which is of the Abt two-plate type, is used on inclines exceeding 1 in 10, the maximum gradients being 1 in 8, and on the adhesion sections 1 in 50. The minimum radius of the curves of the adhesion track is 262 ft., and that on the rack section 328 ft. On the adhesion sections of the line the maximum speed is 28 m.p.h., while on the rack section it varies between 8.6 and 12 m.p.h.

The engines, the total weight of which (48 tons) is divided practically equally between the mechanical and electrical parts, measure 46 ft. 3 in. over the buffers, the total wheel-base being 28 ft. 7 in. Their general design is shown by fig. 1; the two driving bogies, which were constructed at the Swiss Locomotive and Machine Works at Winterthur, have a wheelbase of 6 ft. 7 in., and their frames are mounted on the roller-bearing axle boxes by means of semi-elliptical springs. The two motors of each bogie are arranged with bracket bearings rested on the axles, the casings being supported on the end frames of the bogies through the intermediary of springs, so-called sliding support being provided to prevent "hunting." Each of the motors is designed for a continnous output of 140 h.p. at the wheel rim and 162 h.p. for one hour, or a total of between 640 and 650 h.p. The normal and maximum tractive efforts for a total train weight of 108 tons are, respectively, 19,000 and 30,800 lb. The motors drive on to a common intermediate shaft for rack and adhesion operation, through a pinion combined with a friction clutch and a large gear wheel. The intermediate shaft carries two pinions; one engages the gear wheel keyed on the driving axle and serves for adhesion operation, while the other engages a gear wheel bolted directly to the rack drive and rests on the driving axle through the intermediary of a quill. The total gear ratio for adhesion operation amounts to 1 to 6.2, and for rack operation to 1 to 5.6. On the adhesion sections the rack drive runs light, but on the rack sections the adhesion drive assists the rack drive.

The speed is controlled in twelve steps by the master controller, which is connected to a step-down transformer arranged for differential connection by means of electro-pneumatically-operated contactors working in conjunction with two bridging coils. An isolating switch is provided in the motor circuits for cutting out any defective motor.

The arrangement for short-circuit braking is as follows:—The fields of the four driving motors are connected in series during braking and separately excited with direct current. The armatures of the motors are also in series, with braking resistances in circuit. The regulation of the speed during braking is ensured, as in the case of running, by varying the excitation current of the exciter by means of the master controller. The braking resistances are adjusted automatically to the required values, according to whether braking is applied on an adhesion section or on a rack section.

For the purpose of one-man operation provision is made for a foot lever in each driver's cab under the controller, while a push-button is arranged on the side of the driver's cab opposite to the controller. When the foot lever or the push-button is released, the so-called "dead man's" device comes into operation and applies the quick-acting brake after the train has travelled a distance of 14 yards, and, at the same time, causes the release of the main oil circuit breaker.

The auxiliary equipment of each locomotive comprises two 8-h.p. motor-driven fan sets (one each for the cooling of each pair of driving motors), two fans driven by a single motor for cooling the step-down transformer and the braking resistance, and a 120-ampere-hour nickel-iron battery with its charging set. The battery supplies, in conjunction with an auxiliary motor-generator set, the current for the operation of the control gear, and also serves as a stand-by for the motor-generator set in the event of the failure of the line pressure. The electrical equipment also includes two standard collectors of the Swiss Federal Railway type, isolating switches, and a h.p. oil circuit breaker with both remote-control and hand-operating gear. In view of the severe gradients, the engines are provided with Hardy vacuum brakes as well as with two hand-brakes.

Each locomotive body is mounted on a longitudinal channel-section frame; it comprises the two drivers' cabs and the end structures for accommodating the auxiliary batteries and equipment. The main transformer, the bridging coil, and two air tanks are located in the central compartment. On the upgrade side there is a luggage compartment behind the driver's cab, while forward of the rear cab is a compartment for the control mechanism; a small side passage is provided between the two cabs. A feature of the bodies, which were built by the Swiss Carriage and Lift Works at Schlieren, is that to meet the prescribed deadweight requirements aluminium has been extensively used for the floors, sides, roofs, partitions, and end structures.

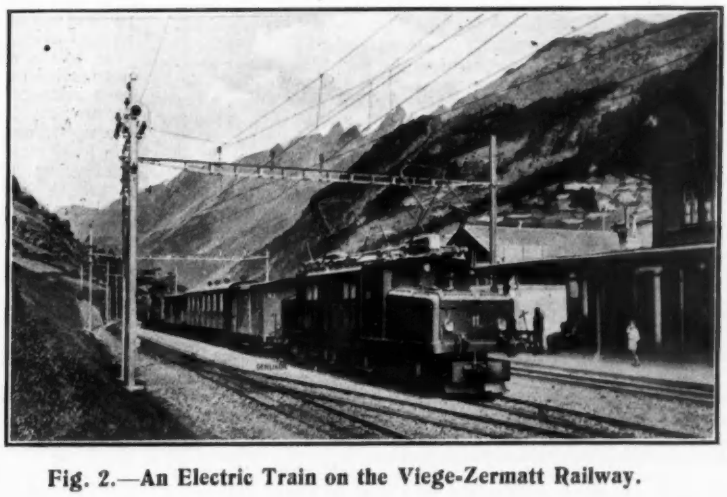


Fig. 2.—An Electric Train on the Viege-Zermatt Railway.

Apart from the actual mountain section, a section 5½ miles long is now in course of construction in the Rhone Valley to link up the Viege-Zermatt and the Furka-Oberalp railways, which will permit of the running of through carriages from the system of the Rhaetian Railway from St. Moritz *via* the Furka-Oberalp line to Zermatt.

Distribution Voltage Standardisation.

Synopsis of a statement issued by the Council of the Institution of Electrical Engineers.

FOLLOWING on the adoption of a standard electric lamp voltage of 230 V by the British Engineering Standards Association (B.E.S.A. publication No. 77-1925: British Standard Voltages for New Systems and Installations) for both alternating- and direct-current systems, after prolonged consultation with all the interests affected and with the approval of the Electricity Commissioners, the Council of the Institution of Electrical Engineers studied the various problems involved and has issued a statement thereon.

In the absence of information about the extent to which different voltages are at present in use on low- and medium-voltage distribution systems, the Electricity Commissioners consented to take a census and practically all undertakers furnished statistics, which are tabulated in the April issue of the I.E.E. *Journal*. While the data are somewhat incomplete, they are far more complete than any hitherto available. Table I affords a general idea of the situation; the figures refer to the total lighting connections in the country as at March 31st, 1927, expressed as the equivalent number of 30-watt lamps.

TABLE I.—Total Lighting Connections, 1927.

230 volts.	Range 220/240 volts (excluding 230 volts).	Range 200/215 volts.	Above 240 volts.	Below 200 volts.
12¼ millions	18 millions	21 millions	2½ millions	2¼ millions

On several large systems changes in the general distribution voltages have already been successfully carried out and it is the Council's opinion that, with the assistance of the Commissioners, declared voltages within the range of 220/240 volts can be standardised at 230 volts by gradual adjustment over a period of a few years with very little expenditure.

For voltages below 220 a change to the standard voltage would involve considerable expenditure; it would be safe to take the minimum figure as £10,000,000 and the maximum as £16,000,000.

For voltages above 240 the cost would be about 10 per cent. of the above figures, but it is not practicable to attempt any standardisation of these at the present time. If, and when, the greater part of the country is using the standard voltage, the addition of the undertakings now operating at 250 volts would probably take place automatically. At the present time, however, it does not seem fair to ask such undertakings to make an immediate sacrifice in distribution efficiency without a more immediate prospect than now exists of obtaining the more indirect benefits of standardisation.

Undertakers with voltages below 220 would, by raising their voltages to the standard, gain very greatly in distribution efficiency and better utilisation of mains. The extent to which this could be set against the cost of standardisation depends largely on the rate at which the increased capacity of the existing mains can be absorbed by increased growth.

The Commissioners have assured the Council of their sympathy and they are already taking steps to ensure that the standard voltage shall be adopted for all new areas. The Council feels, however, that the greatest assistance in promoting standardisation is the Commissioners' agreement: (*a*) to call the attention of all undertakers who have non-standard supply voltages near the standard voltage of 230 (*i.e.*, say within a range of 220-240 volts) to the powers reserved to the Commissioners under No. B3 of the Regulations for Securing the Safety of the Public and ensuring a Proper and Sufficient Supply of Electrical Energy, enabling them to modify the specified voltage variation; and (*b*) to intimate to such undertakers their readiness to exercise such powers in favour of any undertaker who wishes to have a wider range of voltage variation for the specific purpose of making an immediate commencement with standardising the distribution voltage.

As the result of conferences with the British Electrical and Allied Manufacturers' Association and the Electric Lamp Manufacturers' Association, the B.E.A.M.A. Council has recommended each of its sections concerned to take all practical steps to assist in accelerating the change-over of existing systems to the standard voltage.

The section of the B.E.A.M.A. dealing with domestic appliances has agreed when a change-over is made in any particular district to assist so far as is possible by giving a preferential discount on parts of apparatus supplied to replace those rendered useless by the change-over. It would facilitate matters greatly if this preferential discount were to apply only to orders received from supply authorities and not to replacement orders received from contractors.

The E.L.M.A. issued a notification to the public on April 2nd, 1929, indicating that the prices of certain popular types of lamps for general lighting-service purposes were being reduced on and from that date, and addressed a letter on February 1st, 1929, to the I.M.E.A. and other associations of supply authorities, stating that it was prepared to quote an additional scale of discounts off the net invoice prices for lamps delivered to any supply authority which were bought directly from the members of the E.L.M.A. for specific change-over work in connection with the adoption of a standard 230-volt pressure.

As a result of the meetings and discussions which have taken place during this investigation the Council has been more and more impressed with the advantages which would result to the industry from a wider standardisation of voltage throughout the country, particularly in adjoining areas, where the difference in some cases is only 10 or possibly 20 volts. This view is also strongly supported by the Electrical Contractors' Association, whose Council has recently been considering the matter.

Electrification in Jugo-Slavia.

An outline of the national aspirations, planned and to be controlled by the State on similar lines to British policy.

(Communicated.)

ARRANGEMENTS are now being made in Jugo-Slavia for the re-organisation and development of electrification throughout the kingdom along similar lines to those followed by the Central Electricity Board in Britain. A special Department will be formed as a sub-section of the Mechanic Electro-Technic Department of the Ministry of Public Works to collect information and prepare a general plan for the electrification and rational exploitation of the natural sources of energy of the kingdom. The actual exploitation of the State electrical undertakings, when completed, will be in the hands of a special section of the Industrial Department of the Ministry of Commerce and Industry, which will also supervise the exploitation of the electrical undertakings of concessionaires. When the general electrification scheme has been drawn up, a special section of the Ministry of Communications will be established to evolve a plan for the electrification of the State Railways.

To assist the various Ministries in connection with their schemes, a special advisory committee for the electrification of the country will be established, comprising eight members. Three of the members will be chosen from the Ministry of Public Works, representing the Electro-Mechanic, Posts and Telegraphs, and Hydro-Technical Departments. The other five members of the advisory committee will be chosen to represent the Ministries of Commerce and Industry, of War and Marine, of Finance, of the Interior, and of Forests and Mines.

Applications will be considered by the Government for concessions to install and operate distribution networks in various parts of the country, districts, and communes. The erection of power stations by public institutions and private concerns, however, will be allowed only in those districts where the State has not carried out any schemes and where electricity has not yet been introduced. Even in the districts where concessionaires are now entitled to generate electrical energy, the State reserves the right, upon paying suitable compensation, to close down the local stations if the concessionaires are unable to supply cheaper energy than that obtainable from State power stations. The price to be charged for electricity by concession holders will be determined by the Government, and will be adjusted so that the net profit of the undertakings never exceeds 10 per cent. A royalty of 2 per cent. on the gross receipts of the concessionaires will be payable to the Government. When concessions are granted to foreign organisations it is to be stipulated that at least two-thirds of the technical personnel must be subjects of Jugo-Slavia, while when concessions are granted to local companies it is to be stipulated that the entire technical staff must be of Jugo-Slavian nationality.

The erection of State central power stations and transmission lines will be financed out of a special national fund to be founded for the electrification of the country. This fund will be administered by the Ministry of Finance, and will be maintained by budget grants. Royalties from concessionaires will also be paid into this fund, in addition to fines incurred by concession holders through failing to complete their installations within the time limits established by the Government. It has been decided to standardise the frequency at 50 cycles per second throughout the country; 220 V will be used for electric lighting and similar purposes, and 380 V for electric motors. The h.p. lines in towns will operate at 3,000 V, but in the country pressures of 6,000 V, 10,000 V, 20,000 V, and 30,000 V will be allowed, whilst main feeder transmission lines will operate at 60,000 and 100,000 V. It will be necessary for all existing supply undertakings in Jugo-Slavia to adjust their systems in accordance with the above-indicated standards.

Low Power-factor Measurements.

An outline of investigations carried out at the National Physical Laboratory for the British Electrical & Allied Industries Research Association, with particular reference to the determination of the power loss in high-voltage cables.

By E. H. RAYNER, M.A., D.Sc., M.I.E.E., W. G. STANDRING, M.A., R. DAVIS, M.Sc., and G. W. BOWDLER, M.Sc.

(*Extracts from a paper read before the* Meter and Instrument Section *of the* Institution of Electrical Engineers.)

METHODS of measuring cable dielectric losses have been studied with the object of determining the nature and magnitude of the various errors to which the different methods are liable. As the result satisfactory methods and apparatus have been evolved for use at power frequencies and pressures up to 200,000 volts.

At high voltage the most important errors are those due to stray capacitance; interaction between different parts of the circuit induce currents in the measuring apparatus which alter especially the phase relation between current and voltage, and seriously affect the accuracy of the measurements.

The power factor of modern high-voltage cables is usually less than 0.01. It is important to be able to measure this quantity with some accuracy, and sensitivity and accuracy to a value of 0.0001 have been aimed at and achieved. Power factors, when small, if expressed as a fraction of unity, denote, as a fraction of a radian, the amount short of a right-angle by which the current leads the voltage, and phase angles of resistors and other measuring apparatus expressed in the same unit can be directly added.

By various methods, including those in general use, the power factor of a condenser load was measured, and the results obtained by the different methods were compared. For this purpose a load of constant power factor was desirable, and a mica condenser of 5.000 $\mu\mu$F capacity, designed for radio frequencies and 40 kV, was lent by the Dubilier Condenser Co. It had a power factor of 0.0013, which proved to be a convenient value for the various methods. During the earlier part of the work the apparatus available (high-voltage wattmeter, resistor, and air condenser) was only suitable for 30,000 volts. Large discrepancies were observed between the results obtained by the different methods; but, partly through studying the variation of discrepancies with frequency and voltage, the various sources of error were eventually determined and agreement to 0.0001 power factor was reached by all the methods.

At this stage it was clear which methods were suitable for carrying on the work to higher voltages, and that an air condenser and some form of resistor were required. Accordingly a method was developed of shielding a simple resistor of flowing water, so that the current is in phase with the voltage within about 0.0001 radian. A resistor has been developed on these lines for 150 kV.

The standard of reference was a specially designed air condenser of the parallel-plate type, suitable for 100 kV. The use of a condenser with the Schering bridge form of circuit has been found to be almost free from errors of importance which are difficult to allow for.

The authors' conclusions are that an air condenser designed on the lines indicated is the most reliable standard for phase-angle measurements, and that by its use, and taking the necessary precautions, accurate measurements should be obtained on a Schering bridge. If other methods are employed, it is desirable to calibrate the equipment under actual conditions of use against an air condenser.

It is to be noted that the most suitable methods of measuring power factor have proved to be those which measure the quantity desired most directly and conveniently. Of the two principal methods available, the Schering bridge and the compensated wattmeter method, neither requires a knowledge of voltage, current, or power. The required information is obtained as a time-phase relation in terms of the frequency and of simple variable capacitances, inductances, and resistances.

Appendix 1 describes the condenser; its plates are made of aluminum riveted to steel angle frames. The high-voltage plate is between the two low-voltage plates, and has a rounded edge to avoid ionisation of the air. The two low-voltage plates have a surface 8 ft. long by 4 ft. high, giving a total capacity to the centre plate, at a separation of 10 cm, of about 500 $\mu\mu$F. The guard plates project beyond the measuring plates and cover them at the back, except where holes are cut to admit porcelain supports. The low-voltage and guard plates are supported on a wooden frame by porcelain insulators of the pin type, all pins in the wooden frame being connected to guard or to earth. The frames are mounted on rollers so that separation between high- and low-voltage plates may be varied. The high-voltage plate is suspended by porcelain rods at the two upper extremities, one from three and the other from two points in the roof. Large flat plates are difficult to obtain, and the high-voltage plate (14 ft. by 7 ft.) is 1 cm out of flat at the centre, *i.e.*, about 10 per cent. of the separation when the latter is 10 cm.

The design of the edges of the plates was based on the results of an investigation of the electrical stress at the surface of model electrodes immersed in an electrolytic tank. The method is used by the Aerodynamics Department of the National Physical Laboratory for studying flow past aerofoils, the hydrodynamical problem being mathematically identical with the electric-field problem. Equipotential surfaces are traced out by a pantograph attached to an exploring electrode in a tank, a valve amplifier transmitting to telephones the potential difference between this electrode (a fine platinum wire projecting from a thin glass tube) and a point chosen on a potential divider connected across the supply. The main object was to study the increase of stress at the edges of the plates, trying various curvatures, so that the design could be founded on a knowledge of what reduction of working voltage might be expected as the result of increase of the electric field.

The design has proved a satisfactory engineering compromise between the various factors involved. A separation of 10 cm is suitable for measurements at 100 kV, and a separation of 20 cm for 200 kV. Theoretical treatment appears to give higher values for the increase of stress at edges than those obtained by the experimental method.

Appendix 2 describes the special resistor, the measuring section of which consists of two tubes in the centre about one in. apart and a guard system of 12 tubes symmetrically spaced on a circle of 9 in. diameter around the main tubes; the tubes are two metres long. The water flows up half the tubes and down the other half; it is circulated through the tubes and a tin-lined cooler by a small centrifugal pump lined with tin to prevent contamination; a reservoir is also included. Specially-drawn "Keramot" tubing was obtained from Messrs. Siemens Bros. & Co., and all tubes of one size were forced through the same die in order to ensure uniformity of cross-section. Two lengths of one metre are joined to form a unit, and the mid-points of the "up" and "down" tubes are connected together electrically, so as to maintain equality of potential distribution when the temperature-rise is considerable. Cocks are fitted, and the flow is adjusted to allow the same temperature-rise in main and guard tubes. The main tubes are supported at the top by porcelain from the guard casting, and at the bottom are connected by lengths of rubber hose to earthed joints in the water circuit. The water in these connections has a high resistance whose shunting effect on measuring apparatus is negligible, but it is shielded from the high-voltage field by an earthed screen, and the shunting effect of its earth capacity must be allowed for. The tube system is surrounded by an earthed wire cage.

X-Ray Kinematography.

A brief account of a German method of photographing Röntgen-ray images direct with a kinema camera.

By Dr. A. Salmony, Berlin.

HITHERTO it has not been possible to take X-ray kinematograph films direct, for the simple reason that the reducing lens used to give the small film pictures becomes inoperative when applied to X-rays, because of their greatly reduced wave-length, as compared with that of light. X-rays, in fact, pass straight through both glass and quartz lenses without appreciable refraction. Consequently an X-ray photograph has to be taken life-size. The photograph can, of course, subsequently be reduced.

Recently, however, a Berlin radiologist, Dr. Gossheiner, has succeeded in photographing the visible image made by the X-rays on the fluorescent screen direct with a camera giving the necessary reduction for film work, not only in the case of bone structures, but also of the deep-seated organs.

For this purpose a special form of screen has had to be developed. Once this became available an enormous saving in the cost of the X-ray photographs resulted, amounting to something like 30 : 1. By the old process, for instance, the photograph of a human lung required a plate of some 1,200 sq. cm., whilst with the new process this will be reduced to about 5 sq. cm. At the same time much of the complicated auxiliary apparatus, such as the special cabinet, protective screens, &c., can be dispensed with.

The new process is a most important advance, as it permits the movements of the inner organs to be followed, and this should be of the greatest use in the diagnosis of a whole series of diseases. For instance, in the early stages of cancer of the stomach, the diseased portion is microscopically small and not easily detected in an ordinary X-ray photograph, but much more so in kinematographic film. Other diseases, again, are characterised, not only by change of form, but also by disturbances in the normal functioning of the organ, *e.g.*,

failure of the ventricles of the heart is a form of disease which could not be discovered at all by an ordinary X-ray photograph, but readily by means of the new moving film type. The new process should, in fact, make it possible to detect the earliest symptoms and the smallest functional disturbances with ease.

The discovery sounds a simple one, but actually it involved a great deal of experimental work. It is well known that the luminous intensity of the ordinary fluorescent screen is extremely low, so that an exposure of several seconds would be needed to obtain a photograph from it. On the other hand, the kinematograph film necessitates some 16 pictures per second. It is impossible to increase the power of the X-ray tube without risk of injury to the patient, so that the investigators had to concentrate on utilising a low intensity illumination to the utmost, and both camera and film had to be arranged to be of the highest possible efficiency. Eventually Dr. Gossheiner and his collaborators succeeded in obtaining 16 or even more pictures per second continuously for a period of 10 seconds. The film can subsequently be slowed down and the changes examined at leisure.

It may be of interest to describe just how such a film is taken. The patient is subjected to the X-rays as usual, and after passing the part under examination the rays fall on the special luminous screen, which the doctor can keep under observation. The film camera is situated behind the doctor (see fig. 1) and is operated either by hand or by a clock-spring motor.

The new method is not only advantageous from the point of view of the patient, but will also greatly influence methods of instruction to medical students, as it will, for the first time, make it possible to exhibit the motions of the internal organs on a large scale to large audiences. Figs. 2 and 3 show small portions of two of these new films (heart and lung).

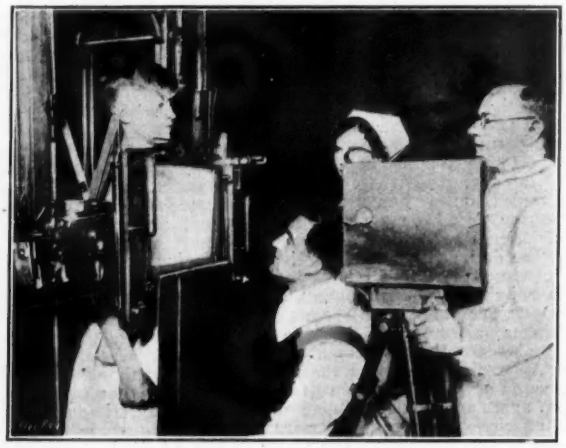
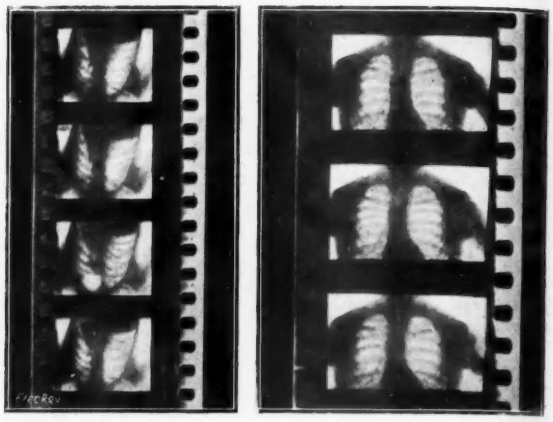


Fig. 1.—Film Camera and Luminous Screen.



Figs 2 and 3.—Samples of Kinema Films.

Modern Tramcar Control.

A brief description of the control equipment made by the British Thomson-Houston Co., Ltd., for a "pay-as-you-enter" tramcar introduced in London.

CONSIDERABLE attention has been focussed on the "pay-as-you-enter" tramcar* which has been put into service by the Metropolitan Electric Tramways, Ltd., in London, and in view of the special conditions specified a description of the control equipment should be of interest. The equipment was designed to the specified requirements of the engineers of the London Underground group of railways and tramways, and the various questions of suitability for the service conditions, space available, accessibility, durability, weight, and cost had all to be carefully considered from the various angles of the operating Companies.

The fact that the controller had to be designed to be operated by a seated motorman at once affected its height, and the design had to be laid out accordingly. The result is a scheme of control which is claimed to meet all the arduous requirements of heavy city service. The operation of one handle accelerates the car, retards it, introduces field shunting when the conditions warrant that being done to secure increased free-running speed, and, finally, causes all power current to be ruptured on contactors external to the controller itself.

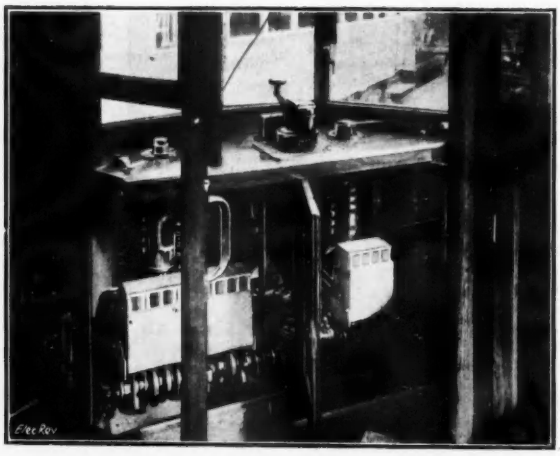


Fig. 1.—Driver's Cab, showing Control Gear Locker Open.

The car is fitted with two B.T.-H. type-509 AS traction motors of 50 h.p. each, mounted on "maximum traction trucks" having 28-in. driving wheels, and the control gear, a product of the British Thomson-Houston Co., Ltd., is mounted in a somewhat unusual manner, as may be noted from the illustrations. It will be seen from fig. 1 that the controller is housed in a wooden locker placed at an angle across the car platform and suitably lined with fireproof material, thus obviating the necessity for the usual sheet-steel cover. The operating handle, reverser, and motor cut-out spindles project through the surface of the polished-top of the locker, and the working parts (type B527) are mounted on open steel framework, which affords complete access to the interior through two doors in front of the locker and a third door, opening through the driver's partition, to the left-hand side of the controller. Fig. 1 also shows the location of the removable arc chutes. The controller, removed from the locker, is shown in fig. 2, in which the general assembly within the framework is clearly visible, while fig. 3 is a more detailed view of the gear drive connecting the vertical and horizontal shafts, and also the arrangement of the cam-operated contactors. It will be noticed that some of the contactors are provided with "knock-off" cams to ensure that they will

* Elec. Rev. November 15th, 1929, p. 873.

open mechanically quite independently of gravity operation.

In order to reduce arcing of the controller to the minimum the B.T.-H. patent line-breaker equipment is fitted and the control handle is so arranged that the familiar "dead man" feature can be incorporated. When the controller handle is moved to the first power point, an auxiliary switch is closed, thus energising the operating coils of the line-breaker contactors through an auxiliary contact-finger unit. The line-breaker closes, thus connecting the motors to the trolley wire with all the starting resistances in series. Should the controller handle be moved too quickly over the first power point, however, the line-breaker will not close, which is a valuable characteristic, as it effectively protects the equipment from violent acceleration and consequent overloading when starting from rest.

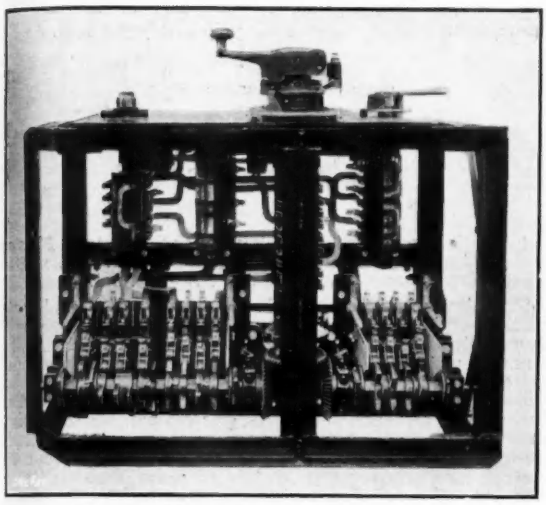


Fig. 2.—Controller and Framework.

The car may be notched up to full speed in the usual way, but any movement of the controller handle from the power point towards the "off" position immediately opens the auxiliary switch, thus interrupting the control circuit of the line-breaker, which opens. A fresh start can then only be made by bringing back the controller handle to the "off" position; on proceeding to the first "notch," the auxiliary control finger enables the operating-coil circuit of the line-breaker to be again completed, which ensures that the power circuit is always made and broken on the line-breaker contacts and not on the controller.

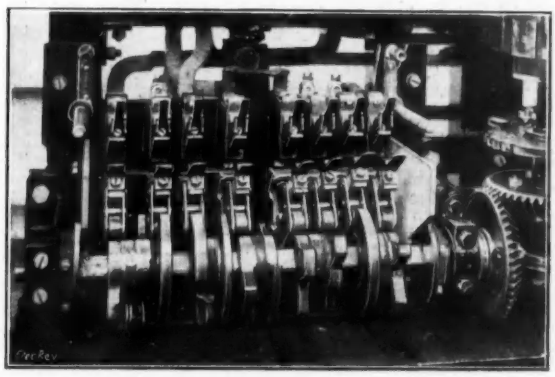


Fig. 3.—Gear Drive to Horizontal Shaft.

In the event of the failure of voltage, or the trolley pole leaving the overhead collector wire, the line-breaker will automatically open and a fresh start can then only be made after the restoration of voltage by first bringing the controller to the "off" position.

Hydro-electric Development in Canada.

Extracts from the Annual Review of the Dominion Water Power and Reclamation Service.*

THE steady growth of water power development witnessed throughout the Dominion of Canada during the past few years was substantially maintained during 1929. The total capacity of new installations brought into operation during the year amounted to 378,400 h.p., bringing the total installation for the whole Dominion up to 5,727,600 h.p. The capital expenditure involved in the development, transmission and distribution work for this new power represents a very considerable proportion of the total expenditure in building construction in Canada, the 1929 outlay involving probably more than $75,000,000, while not less than $320,000,000 will probably be required to complete the undertakings planned for the next three years.

The largest of the activities in British Columbia include developments under way or in prospect by the various subsidiaries of the British Columbia Power Corporation, the West Kootenay Power and Light Co., the East Kootenay Power Co., and the Powell River Co. At the main Jordan River power station plans have been prepared and work commenced on the installation of a fourth unit of 18,000 h.p. capacity which, it is expected, will be in operation in 1930. The same company has investigations under way in connection with the development of a large power site on the Campbell River for the supply of future power needs on Vancouver Island. The Western Power Co. of Canada commenced active construction during the year of the initial stage of an ultimate 188,000-h.p. development at Ruskin on the lower Stave River. The initial development includes the reconstruction of the company's Stave Falls Railway, the building of a concrete dam 180 ft. in height, two penstock tunnels of 21 ft. in diameter, and a power station to accommodate two 47,000-h.p. units, one of which is to be in operation by the autumn of 1930. The Bridge River Power Co. continued the construction of its undertaking on the Bridge River, the programme for which has been altered somewhat, due to commencing the construction of the Ruskin development. The first part of this undertaking is expected to be completed by July, 1930. The initial development may be increased to 80,000 h.p., instead of the 56,000 h.p. originally planned. The transmission line which will carry the power to the Vancouver district will be of 220,000 volts, instead of 154,000 volts as originally planned.

The West Kootenay Power & Light Co. brought the third generator of its first 75,000 h.p. of plant at South Slocan into operation in June, thus completing the development. The same company has made extensive field surveys preparatory to the early development of a 40,000-h.p. plant on the Adams River from which power will be transmitted to the company's system, *via* the Okanagan Valley. The Powell River Co. has recently acquired rights on the Lois River, and surveys are under way for the development of about 18,000 h.p. for use in the company's pulp and paper mill at Powell River. Construction has commenced on Falls River of the initial installation of 6,000 h.p. of an ultimate 32,000-h.p. scheme. The East Kootenay Power Co. conducted investigations for a development of about 20,000 h.p. at Phillip's Canyon on the Elk River.

In Alberta the Calgary Power Company brought into operation its 36,000-h.p. development at the Ghost site on the Bow River. An agreement was also made with the City of Edmonton for the interchange of power, and a 132,000-volt transmission line will be completed early in 1930 to carry power 175 miles from the Ghost development to Edmonton.

Excellent progress was made with the construction of the first hydro-electric plant (six 14,000-h.p. units) to be erected in Saskatchewan by the Churchill River Power Co., a subsidiary of the Hudson Bay Mining and Smelting Co. The plant is expected to come into operation in the autumn of 1930, and a transmission line is under construction to convey the power to Flin Flon Mine and smelter of the Hudson Bay Mining and Smelting Co.

* Copies may be obtained free of charge on application to the High Commissioner of Canada, Canadian Building, Trafalgar Square, London, S.W.1., or to the Director of the Dominion Water Power and Reclamation Service, Ottawa, Canada.

In Manitoba two large hydro-electric undertakings are under construction on the Winnipeg River, the first at Seven Sisters Falls by the North-Western Power Co., a subsidiary of the Winnipeg Electric Co., and the second at Slave Falls by the City of Winnipeg. The Seven Sisters development of the North-Western Power Company will ultimately comprise an installation of six units of 37,500-h.p. each, operating under a head of 66 ft. The City of Winnipeg power station is designed to contain eight unts of 12,000 h.p. each, two of which will comprise the initial installation.

In Ontario installations totalling 48,750 h.p. were added during 1929, while other undertakings under way will increase the province's total by 123,000 h.p. during 1930. New developments completed during 1929 include the 28,200-h.p. plant of the International Nickel Co. of Canada at the Big Eddy dam on the Spanish River, and one of the Algoma District Power Co. at High Falls on the Michipicoten River, with an initial installation of 11,000 h.p.

The Ontario Hydro-electric Power Commission completed three new developments during the year, one with an installation of 2,200 h.p. at Trethewey Falls, on the South Muskoka River, to supplement the supply to the Georgian Bay system, another at Elliott Chute on the South River with an installation of 1,800 h.p. to supply the Nipissing system, and a third with a 5,000-h.p. installation at the power-storage dam at Lower Ear Falls on the English River. The latter installation will supply power to the Howey Mine in the Red Lake mining district. Owing to the rapid growth of power demand at Fort William and Port Arthur, construction work being carried out by the Commission for the new 54,000-h.p. development at Alexander landing on the Nipigon River was accelerated with the object of having the plant ready for operation in the autumn of 1930. Work was also advanced on the installation of a tenth unit of 58,000 horse-power in the Queenston station on the Niagara River which is scheduled for completion in 1930. An additional 70,000 horse-power was taken during the year by the Commission for the Niagara system, and an additional 6,000 horse-power for the Rideau and St. Lawrence systems under its contracts with the Gatineau Power Company. Work was also carried forward in the duplicating of the 220,000-volt transmission line to carry the Gatineau power to Toronto.

Developments in early prospect by the Commission include one of 12,000 horse-power at Ragged Rapids on the Musquash River to supply the Georgian Bay system and one at Chats Falls on the Otwaw River to be jointly carried out with the Chats Fall Power Company, which has a licence from the Province of Quebec to develop the Quebec half of this power. The combined development is expected to have an installation of about 200,000 horse-power.

Over 208,000 h.p. was added to the water-power installations in Quebec province during 1929, while new undertakings and extensions to existing plants actually under construction will add a further 1,000,000 h.p. The 200,000 h.p. placed in operation include principally the new plant of the Montreal Island Power Co. on des Prairies River, near Montreal, and the addition of several large units to the existing stations of the Gatineau Power Co. and the Shawinigan Water & Power Co. The Gatineau Power Company, a subsidiary of the Canadian Hydro Electric Corporation, Ltd., is now supplying 182,000 h.p. to the Hydro-electric Power Commission of Ontario, 150,000 h.p. of which is being transmitted over the present 220,000-volt line directly to Toronto. A new transmission line of 110,000 volts was also completed between Gatineau and Hawkesbury. The Montreal Island Power Co. placed in operation the 72,000-h.p. initial installation of its hydro-electric plant on des Prairies River, near Montreal, the ultimate capacity of which is to be 12,000 h.p. A new feature of this plant is the adjustable-blade propeller turbines operating under heads varying between 18 ft. and 26 ft., the lower head reducing the present capacity of 42,000 h.p. The entire output of this plant is being taken by Montreal Light, Heat and Power Consolidated. The Beauharnois Light, Heat and Power Company has commenced construction on a most important development on the St. Lawrence River, utilising a descent of some 80 ft. between lakes St. Francis and St. Louis. The first units of the project are to be in operation supplying 200,000 h.p., or possibly 350,000 h.p., by October, 1932, the initial development being designed for 500,000 h.p. The proposed works include a power and ship canal approximately 15 miles in length, 3,000 ft. wide and 10 to 27 ft. deep. The power station, locks and sluice gates are to be at the lower or Lake St. Louis end. It is expected that one-half of the power will be used locally and in the Montreal area, 150,000 h.p. being already contracted for by Montreal Light, Heat and Power Consolidated, while the other half will go into the province of Ontario to fulfil a contract made with the Hydro-electric Power Commission of Ontario to supply 250,000 h.p. at a rate of $15.00 per horse-power per annum.

In New Brunswick the St. John River Power Co. completed the installation of the second and third units of 20,000 h.p. each in its hydro-electric development at Grand Falls on the St. John River, thus bringing the capacity to a total of 60,000 h.p. The town of Edmunston is enlarging its hydro-electric development on the Green River by raising the dam to secure additional head and by adding a new unit of 1,050 h.p.

The year 1929 has been the most active in the history of hydro-electric development in Nova Scotia, particularly due to the activities of the Nova Scotia Power Commission, marking the addition to its systems of four new plants with a total installed capacity of 33,900 h.p., which more than doubled the generating capacity available at the end of 1928. On the Mersey River the Commission completed three new hydro-electric developments; the first plant at Upper Lake Falls has an installed capacity at higher heads of 7,600 h.p., and the dam provides a storage capacity on Rosignol Lakes of about 512,000 acre ft.; the second plant at the Lower Lake Falls has a capacity of 10,600 h.p.; and the third at Big Falls a capacity of 12,700 h.p. The Commission has undertaken to deliver 105,000,000 kWh per annum at a maximum load of 20,000 h.p. to the Mersey Paper Company at Brooklyn for the company's newly-constructed pulp and paper mill.

Reviews.

Introduction to Statistical Mechanics for Students of Physics and Physical Chemistry. By J. Rice, M.A. Pp. x+333. London: Constable & Co., Ltd. Price 18s. net.

Statistical mechanics controls the motions of the ultimate particles of the machinery and tools of the engineer in the same unobtrusive way that enzymes, osmotic forces, and the like normally regulate the life of complex organisms. Only under extreme conditions is the underlying mechanism obvious. These are, however, obtained in a few cases electrically when instruments are operated at the greatest possible sensitivity, and give rise to the various Brownian fluctuations that limit voltage amplification by thermionic valves, and prevent the use of current-measuring devices of more than a certain delicacy. A knowledge of the theory of such phenomena is essential for some classes of work, and this again can only be approached through study of the statistical mechanics of more normal processes. Prof. Rice's book provides a complete course for those whose interests lie in this direction, and has the great merit of assuming initially only a very medium knowledge of mathematics. In addition to the classical theory, it deals with both the earlier and more recent quantum theories, including, for example, sections on the Fermi-Dirac statistics, Fowler and Darwin's method of steepest descent, and the kinetics of gas reactions in a homogeneous system. It approaches Mr. R. H. Fowler's "Statistical Mechanics" (Cambridge University Press) neither in authority nor dignity of presentation, but is correspondingly far less difficult to use, and can be recommended at present as the only treatise of its type in existence.

Electric System Handbook, first edition. Edited by C. H. Sanderson. Pp. xii+1167; p. 893. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

The receipt of an engineering "handbook" for review always causes us a certain amount of apprehension, for the true value of a publication of this kind can only be assessed from having lived with it for a considerable period. Will every copy of this, that, or the other "handbook" quickly become dog-eared, annotated, and eventually borrowed on permanent loan like our McGraw-Hill, our Pender, and our Wedmore, or will it retain forever its pristine beauty in the cloistered seclusion of the alcove bookshelf, unseen, unused, and entirely forgotten? Some do one and some the other. The aim of the present volume is to present "the story of the electric system as a whole, in a logical sequence," and in so doing to give "a general description of the component parts of the electric system, tell of their relation, one to the other, and discuss their features of design and operation." Now that may seem to be the natural way in which to plan a volume coming within the category of a handbook, but unfortunately the original aim is often lost sight of among a maze of inconsequential details and unnecessary excursions into barren by-ways, with the result that we can seldom find just that little paragraph, or formula, or constant we are seeking, and our "handbook" soon attains the status of a regretted might-have-been. When, therefore, we find a handbook which, in every sense of that much-misused term, appears at first sight thoroughly to justify its title we are almost constrained to take our courage in both hands and immmediately pronounce a benediction upon it. When a subsequent careful study of the book reveals the astounding fact that we *can* find that long-sought-after circuit diagram, that particular equivalent, and that hitherto elusive performance characteristic curve which should be in many textbooks and which isn't, we can only silently thank whichever gods preside over these matters and vow never again to consign all "handbooks" to . . . . . the alcove bookshelf. The present volume is of the elect, and in a very short space of time we shall doubtless be wondering which guileless "collector" last borrowed it unless we guard carefully the dark secret of its possession. The book is far too exhaustive in treatment to permit of more than a brief reference to its contents. In fourteen sections it covers the ground of electrical energy and its transmission, auxiliary electrical equipment, switchboards, motors, generating stations, the transmission system, a.c. sub-stations, railway sub-stations, d.c. sub-stations for light and power, distribution, protection of elec-

trical apparatus, circuits and systems, inspection and maintenance, electrical engineering tables, standard definitions of electrical words and terms, and finally a 67-page index. In each section the subject matter is confined strictly within the limits assigned to it, and the facts and data are presented in a remarkably clear and able manner. It has been the editor's aim to eschew all higher mathematics, but we think this omission has been carried too far. Some of the basic expressions governing the design of electrical plant might well have been included without sacrificing the broad principles upon which the book has been founded. We think it a pity, too, that the tables of transmission line reactance and charging kVA characteristics have been confined to 25- and 60-cycle circuits, for, while the volume is of American origin, its circulation will no doubt be extensive outside the U.S.A., and data for 50-cycle circuits would have increased the usefulness of the section concerned. We miss what we consider to be another desirable feature, namely, references to articles, papers, and other books where any particular subject may be studied in more detail than it is possible to give in a handbook. While admittedly such references may become more or less obsolete with the passage of time, they may serve a very useful purpose for at least a few years immediately following publication of the handbook, and they can always be replaced with newer references with the issue of revised editions. The volume is printed upon India type paper and handsomely bound in leather covers, the whole being of a size (7 in. by 4½ in.) convenient for carrying about as well as for the desk, and, most important, it represents extremely good value for money. Sanderson is an attractive addition to our electrical engineering *vade-mecums*, and we confidently predict its rapid rise to popularity.

Telegraphy: a detailed Exposition of the Telegraph System of the British Post Office. By T. E. HERBERT, M.I.E.E. Pp. xxv+1199; figs. 735. London: Sir Isaac Pitman and Sons, Ltd. Price 20s. net.

Since the fourth edition of this well-known text-book was issued and reviewed in these pages ten years ago, considerable advances have been made in the telegraph systems of this country. At no time, in fact, in the history of telegraph development has progress been so rapid or so important as has taken place during the last decade, with the result that systems which a few years ago might have been regarded as the *ne plus ultra* of the day are now relegated to a quite subordinate position, or are on the verge of being discarded altogether. In the present edition the author has thoroughly overhauled his earlier work, and has cut out much that was redundant in the earlier editions, and which had become, if not quite obsolete, at any rate distinctly obsolescent—a fact which will be appreciated by those students for whom the work has been principally written. Of the additional matter in the new volume probably the most important sections are those dealing with start-stop printing telegraphs and voice-frequency systems. The importance of these additions may be gauged from the fact that the description of the four types of machine in the start and stop system adopted by the British Post Office occupies 100 pages of the text. Five voice-frequency systems are described, *viz.*, those of Siemens and Halske, Western Electric Co., General Electric Co., Ltd., Selt, and Wald. A short but interesting chapter deals with the research work of the Post Office in connection with the duplexing of these circuits and the development of high-speed channels. The section of the book allocated to the Baudot system has been entirely rewritten and enlarged to accommodate the latest developments in this direction, as likewise has the chapter on high-speed automatic systems.

Instead of going into mathematical proofs in the more distinctly theoretical parts of the subject, *e.g.*, speed of signalling, shunted condenser, &c., the author contents himself with stating the results, referring the reader to the sources from which these have been obtained. The diagrams throughout the book have practically been all redrawn, and will be of great assistance to the student in following the text. In addition to useful appendices given at the end of the work, numerous footnotes, relative to the published papers or works containing fuller details than those given in the text, are subjoined. Complete syllabuses of the Departmental Technical Examination, and the City and Guilds of London (Grade 1 and Final) are added.

The author again acknowledges his indebtedness to those P.O. engineers who have assisted in the production of the book by revising the chapters on the particular subjects with which they are officially identified. It may, therefore, be taken that the work is an authoritative up-to-date exposè of present-day telegraphy in this country.

Electroplating with Chromium, Copper, and Nickel. By BENJAMIN FREEMAN, Ph.D., and F. G. HOPPE. Pp. ix+212; figs. 43. London: Sir Isaac Pitman & Sons, Ltd. Price 21s. net.

Chromium electroplating has not been neglected in the literature of electro-chemistry during recent years. Within the last five years much research has been undertaken and results published, very largely in the United States, while admirable textbooks have appeared and papers have been contributed to the various technical institutions. Whatever may be the merits of the volume under review its justification should not be sought in the lack of other volumes written to meet the specific needs of this wide and expanding branch of technical and industrial science. The subject of this interesting volume covers a wide field in metal-plating technology and gives in condensed form much information in sufficient detail for most practical purposes. While the main sources of information are drawn from authorities in the United States, yet references to European practice are not altogether ignored. Greater attention to the latter would certainly have rendered additional value to the volume, as electroplating is a branch of electro-chemistry that has been most extensively developed in this country. The technical side of the book is up-to-date and kept well to the fore, the description of the various processes is clear and instructive, references to the literature are given in useful amount, and there are several informative line drawings to contrast with some rather poor reproductions of photographs. The information has been selected from many sources with great care, and recent developments are satisfactorily covered and leavened with a sound practical experience. The closely allied subjects of copper and nickel plating are considered in a subsidiary manner. The authors discuss the high current density of chromium and the influence of the current density, temperature, and the composition of the electrolyte on the physical properties of the deposited metal. The gradual evolution of electro-plating as a science is becoming more and more evident in all directions and, while greater efficiency will follow, there can be no doubt that progress in this direction will have valuable reactions. The authors of the volume are, respectively, the technical director and superintendent of the National Chromium Corporation, U.S.A., and hence well qualified to write on the subject. They have aimed at providing a book which will cover the ground, in so far, of course, as it is at all possible for a book to replace actual experience. While fully admitting this limitation, the practical side of a book can undoubtedly be made of great value by emphasising important details which more pretentious works ignore. The balance is well kept, and the subject matter well chosen, being calculated to aid the industrial orientation of the reader's mind. The most important natural laws and theories connected with the deposition of metals are Ohm's Law, Faraday's Laws, the Ionic Theory, and Nernst's Solution Pressure Theory; a knowledge, even partial, of these laws and theories, enables one to form a mental picture of the electro-deposition process and to account for the phenomenon connected with it. It answers much to the same purpose to the electro-chemist as the conception of the ether and latterly the idea of relativity serve to the physicist.

The chemical fundamentals of electro-plating are considered from the point of view of practical requirements in the above work, at some length. The various methods applied for plating base metals, and the cleaning and polishing of surfaces receive the amount of attention, respectively, due to their importance and complexity. Specifications for plating and polishing compounds, and the testing of deposits and solutions are described briefly, and are more descriptive than critical.

Metals are protected by electro-plated coatings by two means. The first is purely mechanical; the plate is made sufficiently dense to prevent the air penetrating to the base and hence causing corrosion; the second is electrochemical, the metal coating in this case has a high solution pressure, *i.e.*, it has a higher position in the electro-motive series than the base metal, protection resulting from the fact that the plate must corrode before the base metal corrodes. Whatever protection copper, nickel, or chromium gives is mostly due to the mechanical exclusion of moisture and air. Chromium has a pronounced tendency to remain in the passive state and it is seldom that it can exert the potential given it in the electro-motive scale. The use of copper or nickel as an undercoating is practicable due to the fact that they are nearly impervious. Being below iron in the series, they can actually hasten the corrosion of iron if there is a break in the plate. In view of the fact that chromium acts in a similar manner to a noble metal, it affords extremely little protection to the underlying base metal, whether of copper, brass, or iron, when deposited in commercial thicknesses, which, for decorative purposes are in the vicinity of 0.0003 in. This thickness of metal is sufficiently porous to allow for the ingress of moist air and form a local battery. The function of the nickel deposit is essentially the protection of the underlying base metal to prevent the formation of the battery between it and the chromium deposit. The nickel deposit must be a complete and non-porous envelope over the article. Baker and Pinner obtained the most satisfactory corrosion resistance by using the following combination over steel, the coatings being 0.00018 in. nickel, 0.0003 in. copper, 0.00035 in. nickel, followed by 0.00002 in. chromium. These results are well confirmed in practice. Work of the highest quality is obtained when the copper plate is buffed. The flowing action of the copper during buffing makes the plate more impervious by sealing up the holes, which gives added life to the deposit.

This book is written with a spirited enthusiasm which never flags, in a discursive and clear style, but might with advantage have been more concentrated in parts. The authors have shown a breadth and originality in the treatment of the subject which will do much to stimulate interest. The volume is based largely on the personal experience of the authors, who are well-known pioneers in this field of electro-chemistry, and it should commend itself to a wide range of technical workers.

Vorschriftenbuch des Verbandes Deutscher Elektrotechniker. (17th Edition, 1930.) Pp. 1,168. Berlin: Verband Deutscher Elektrotechniker, Abt. Verlag. Price 18s.

Some idea of the completeness of the 17th edition of the Vorschriftenbuch, or Rules and Regulations Directory, lately issued by the German Association of Electrical Engineers may be gathered from the fact that it extends to no fewer than 1,168 pages and contains all the rules and regulations and standards in force in Germany in connection with electric lighting and power installations at the beginning of the present year. The work is looked upon as a standard reference book by local and police authorities throughout Germany, they basing any action for infringement or avoidance of the regulations on those set out therein. As compared with the previous edition, various sections have been revised or rewritten and no fewer than twenty-seven regulations have either been added or extended. Of special interest is the section setting out the 264 sheets of standard sizes for electrical components of the V.D.E. and that describing the Association's testing department.

Heat Loss Analysis. By E. A. Uehling, M.E., D.E. Pp. viii+241; figs. 18. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

The volume under review appears to have been written primarily with the idea of providing the purely practical engineer-in-charge of boiler plant with technical data and methods to enable him to analyse the thermal results of boiler performance, and secondly, to help to apply technical knowledge to practical use. In the opinion of the reviewer, while the volume could be of considerable use to a technical student taking a course of mechanical engineering, it will not be of great assistance to the purely practical engineer.

The author has a very wide and sound knowledge of the subject covered. The presentation of the fundamental physical laws governing combustion and heat transmission is clear, comprehensive, and reasonably concise, but when dealing with the application of technical data to practical purposes, the author is not particularly successful, being too diffuse, and spending too much space on non-essentials.

A considerable section is taken up with explanation of what is termed "the equicalorific fuel unit," and the advantages of substituting and using this unit for the calorific value of a lb. of fuel, the proposed unit being the pound carbon unit—that is, the weight of coal containing one pound of carbon—it being contended that the adoption of this unit would simplify all the formula relating to combustion. We find ourselves not only unable to subscribe to this contention, but also consider that the introduction of such a unit is unnecessary, and so far from simplifying calculations relating to combustion of fuel, we consider it makes such calculations more complex than they need be. In any case, such calculations are relatively simple.

In this connection it appears to have escaped the author's notice that the variation of hydrogen content in given classes of fuel is small and, therefore, if a standard ultimate analysis of a particular class of coal is taken as a basis and the heat contained in the flue gases at given final exit temperatures and CO_2 content be calculated, then the percentage value of this heat loss will be substantially correct for all grades of the particular class of coal. The moisture and ash contents can vary over a large range without materially affecting the percentage heat loss corresponding to a given final exit gas temperature and CO_2 content. In addition, it is a relatively simple matter to calculate and show what is the effect of change of hydrogen content, and as the range of hydrogen content is small, any variation can be dealt with as a correction value to standard values for heat losses in flue gases. Thus, to ascertain the flue gas heat loss for any class of fuel is relatively simple. A series of curves calculated from an ultimate analysis of the class of fuel used (this analysis can be obtained from any text-book on fuel) can be made, based on CO_2 and final exit gas temperatures (with possibly a supplementary curve for CO), then a knowledge of the CO_2 and final exit gas temperature will give the heat loss corresponding, and when necessary, which should be seldom, the loss from CO can be ascertained in a similar manner.

The author attempts to introduce a new efficiency termed "operating efficiency." This so-called efficiency is merely a variant of our old and now nearly discredited friend "net efficiency." It is spurious efficiency.

The fact that exit gas temperature rises with excess air is not so well known as it ought to be. In the chapter on "Heat Absorption" the author makes clear why this is so, thus showing that the loss due to excess air is a double-barrelled one.

Loss due to CO formation is examined very thoroughly from many aspects, but only a casual reference at a later stage is made to the fact that, when CO is present this usually means also unburnt hydro-carbons are present, and the loss is therefore greater than that due to CO only. As the loss due to unburnt hydro-carbon will normally increase the CO loss by about 20 to 30 per cent., it would appear to warrant more than a casual reference. No reference is made to dewpoint temperature of flue gases.

Plate VIII is printed upside down, and to read many of the curves the book has to be turned at right angles, which is an unnecessary irritation. The book contains much good information, but is overlaid with unnecessary detail.

Agis, King of Sparta. By Una Broadbent, M.A. London: George Allen & Unwin, Ltd. Price 5s. net.

Amateur dramatic societies connected with electrical firms should obtain this 4-act play and consider it as a possible variant from the usual form of entertainment. We make this suggestion not only because it seems to us a good play and well suited to amateur production (the cast contains twelve principal characters, and Spartan simplicity was more than a phrase) but also because we hold that the electrical world should give preference to its own. As the author is the daughter of Mr. Frank Broadbent, M.I.E.E., of the B.E.A.M.A., and was a niece of the late Mr. A. H. Allen, she is entitled to be regarded as "one of us."

The plot of the play is based on—to use an expressive sentence of the author's—"the struggle of youth to bend the visible world to the semblance of its inward vision, and to keep that vision unbroken by the cruelties of circumstance and the sorrowful wisdom of the old." The tragedy of King Agis, the reformer, is therefore as much a story of our own time as of the third century B.C., in which the action takes place. The historical background is incidental only, but at the same time there is enough of "Attic salt" in the play to remind us that we are not far removed in place or in time from the dawn of our own cultural civilisation.

The construction of the play seems to us to be well and tightly wrought, but a swift production should be insisted on to achieve the best results. There is a real sense of dramatic development and the characters react naturally to changing environment. The blank verse contains many memorable phrases and is skilfully handled, developing in intensity and (we think) quality as the situation becomes more tense; it has the quality that Matthew Arnold found in Homer's poetry—of rising and falling in character in keeping with its subject; thus the crowd talks colloquially, as it might be expected to do.

There are two scenes which give exceptional scope for emotional acting, and the whole—to quote the opinion of a leading tragedy actress—"is a good and sincere piece of work of which the author may well be proud."

Legal.

Claim by the Irish Electricity Supply Board.

In our issue of April 11th (p. 713) we reported that the Electricity Supply Board, Dublin, had applied to the High Court for a declaration that a sum of £6,035 standing to the credit of the Rathmines and Rathgar Urban District Council on account of its electricity undertaking was now vested in the Board, which had acquired the undertaking under the Electricity Supply Act, 1927.

Opposing the Council's argument that the amount had been appropriated for the benefit of the rates, Counsel for the plaintiffs said that it was impossible to state whether the amount was surplus until the end of the financial year when, by resolution, it could be dealt with in one of three ways: by crediting it to the rates; by applying it to the improvement of the district; or by employing it in the reduction of the debt upon the undertaking. When the Board took over the undertaking the balance was immediately vested in the Board and the Council's discretion as to its disposal was annulled.

For the Council it was said that if the money was to be taken over it should be taken over with a trust in favour of the ratepayers of Rathmines.

Counsel for the bank with which the money was deposited (co-defendants with the Council) said that his clients were prepared to obey any order made by the Court with regard to the money.

Mr. Justice Johnston reserved judgment.

Celebritone, Ltd.

Mr. Justice Maugham, in the Companies Court last week, made an order that Celebritone, Ltd., should be wound up under the supervision of the Court. The petitioners for a compulsory liquidation were Philips Lamps, Ltd.

Mr. Gavin Simonds, K.C., for the petitioners, said that the creditors of the company had voted on the question as to what course should be adopted with the following result: For a compulsory order: 48, representing claims for £4,094; for a voluntary liquidation: 37, representing claims for £4,013.

His Lordship said there was strong *prima facie* evidence that the creditors would be paid in full, the company's liabilities being estimated at £9,400 and its assets as being worth £15,000. In view of that he thought the company's liquidation should proceed under the control of the Court.

Wynsor Electric Range Co., Ltd.,

A further adjournment was ordered by Mr. Justice Maugham in the Companies Court last week of the petition by Mr. W. D. Stevens, Casenove Road, Stamford Hill, for the compulsory winding up of the Wynsor Electric Range Co., Ltd.

Miss Wells, who appeared for the petitioner, said she under-

stood that negotiations were still going on for a scheme of arrangement and the company wished for an adjournment of the petition until next term. The negotiations would probably result in a satisfactory solution of the difficulties.

His Lordship adjourned the petition until the first petition day next term.

Welding Company's Capital Reduction.

In the Companies Court last week Mr. Justice Maugham sanctioned a reduction of the capital of the Premier Electric Welding Co. (Newcastle), Ltd., from £60,000 to £25,000.

Mr. Buckmaster (for the company), said that the petition was based on losses due to trade depression in the North of England. The reduction was to be effected by the cancellation of specific shares. The company carried on business as naval architects as well as engineers.

Spurious "Osram" Lamps.

At Colchester Quarter Sessions on April 7th, Philip S. Shanley, a traveller, 49, New Road, London, E.1, pleaded guilty to four indictments charging him with selling certain electric lamps to which the trade mark "Osram" had been falsely applied.

Mr. L. A. Byrne, for the General Electric Co., Ltd., stated that the company was the registered proprietor of the trade mark "Osram." On February 26th prisoner went to four Colchester tradesmen and sold to them what he told them were 100-W "Osram" lamps, at 2s. 6d. each, prisoner saying that the company was offering them at this cheap rate as a concession for a week only. The lamps were stamped with a copy of the "Osram" trade mark and turned out to be a fake. When before the magistrates the prisoner raised the defence that he had been duped by a man named Van der Bourg, who had led him to believe that the lamps sold him were "Osrams." He admitted that from the beginning of January to February 26th he had sold 400 or 500 of these faked lamps. At Southend he went so far as to produce an "Osram" catalogue, and said that the lamps were being sold cheaply to combat Dutch competition.

The Recorder (Sir Henry Curtis Bennett, K.C.) said that it was a very serious class of offence, for the Act was passed not only for the protection of traders but also for that of the public. If the offences were isolated and only committed on one or two occasions he would be inclined to deal leniently with the prisoner, but as he had sold these lamps to numerous people in different places, he would pass a sentence of four months' imprisonment in the second division.

An Electrical Company's Annual Return.

At the Bow Street Police Court on April 16th, the Dynamic Electrical Co., Ltd., and its directors, Messrs. A. Denman and A. S. Welch, were summoned for failing to send to Somerset House the annual return of the company, a copy of the list of members, and financial particulars.

According to a report of the case by *The Times*, Mr. E. Fulton, for the Board of Trade, said that the company was formed for the purpose of harnessing the tides in the Wash, and one and a half million 1s. shares of its original capital were issued to the public. The Board of Trade regarded such defaults as matters of great gravity, because many matters which came into Court in relation to frauds in connection with companies would never have arisen if the provisions of the Companies Acts had been properly observed. There might be cases in which the defaults were due to carelessness or inadvertence, or failure to recognise the importance of the provisions of the Act; but there might be cases where quite different considerations arose.

Mr. Dunbar, for the defence, said that the management of the company was leased out to another company, and there had been difficulty in getting the required particulars. The returns had now been filed, and were in order.

The magistrate asked what business the company had done. Mr. Fulton said that he did not know.

The Magistrate (Mr. Fry) said that it was not a case for the imposition of the exemplary penalty provided by the Act of £5 for every day during which default continued; he imposed fines totalling £120, with £31 10s. costs.

Kinema Sound-film Patents.

The kinematograph dispute between Germany and the United States has come to an end. The Tobis Company in Germany had contended that its sound-film patents were being infringed by the Americans.

Messrs. Warner Brothers, as the result of the arrangement come to, will now be able to show their films in Germany without hindrance, and the fee will be greatly reduced. In return they are giving the Tobis Company a sum, which is not specified, the payment of which will be made over a period of years.

Parliamentary News.

[By our Special Parliamentary Correspondent.]

A Canadian Hydro-Electric Scheme.

In the House of Commons last week Mr. Hannon asked the Secretary to the Department of Overseas Trade whether his attention had been called to the hydro-electric power development scheme on the St. Francois River, in Quebec, designed to meet the growing requirements of the eastern townships of that province; and if he would take steps, when the plans were approved by the Quebec Public Service Commission, to endeavour to secure that the contract for the necessary machinery might be placed in this country.

Mr. Gillett replied that various reports relating to this project, which was known as the Beauharnois scheme, had been sent to his Department which, in conjunction with His Majesty's Senior Trade Commissioner in Canada, had already made, and would continue to make, every effort to secure that as large a proportion as possible of the orders for the necessary plant and material should be placed in this country.

Electricity Charges.

On April 14th Dr. Hunter asked the Minister of Transport whether he could state the number of electricity distributing companies that had capitalised their undistributed profits during the last two years; and if any reductions in the maximum charges of electricity had been made by any of those companies during that period.

Mr. Morrison replied that the information required by the hon. member was not available until the statistical returns for the year 1929 had been prepared.

On April 15th, Mr. Morrison, Minister of Transport, stated that particulars were not available regarding average prices for electricity for lighting only, but the following figures from the returns of the Electricity Commissioners showed the average revenue of all authorised electricity undertakings per kWh sold, respectively, for lighting and domestic supplies, and for power supplies, during the years from 1922-23 to 1928-29.

	Lighting and domestic.	Power.
	d.	d.
1922-23	5.30	1.30
1923-24	4.52	1.14
1924-25	4.20	1.07
1925-26	3.82	1.00
*1926-27	3.59	1.14
1927-28	3.39	0.94
1928-29	3.05	0.86

* Year of coal stoppage.

The Rationalisation of Industry.

As reported in our "Business Notes" to-day, the Lord Privy Seal announced on April 15th the formation of the Bankers' Industrial Development Co., Ltd., to aid in the rationalisation of the basic industries. The information was given in answer to a question by Lt.-Commander Kenworthy, who also asked for information regarding the effects of disarmment and rationalisation upon employment.

Answering this part of the question, Mr. Thomas said that it would not be practicable to identify among the general body of unemployed those whose unemployment was attributable to disarmament and rationalisation, even if it were desirable to differentiate in the treatment to be given to them. Disarmament and rationalisation were both calculated ultimately to improve the economic position of the country, and, therefore, to add materially to the volume of employment generally available.

Transatlantic Telephony Charges.

On April 15th, Mr. Day asked the Postmaster-General whether any negotiations were proceeding for the purpose of making a further reduction in the charges for the Transatlantic telephone service.

The Postmaster-General said the question of reducing the charges in the Transatlantic telephone service was under consideration, but he was not at present in a position to make a definite pronouncement on the subject.

Electricity Supply in Yorkshire.

On April 11th, Captain Dugdale asked the Minister of Transport, in view of the fact that the development of the supply of electricity to Wensleydale and the district surrounding Northallerton was dependent upon the extension of the bulk supply from Darlington to Northallerton, whether he could give any information as to the progress of the scheme and the probable date when the extension would be accomplished; and whether he was prepared to take steps to have this work

expedited in order that a very large area in the North Riding of Yorkshire might have the benefit of electricity.

Mr. Morrison said that the Central Electricity Board had recently adopted the North-East England Electricity Scheme, and he understood that it had set up a district organisation and was arranging its programme of construction. He had drawn the attention of the Board to the point raised, and he had no doubt that in drawing up its programme the Board would be guided by the best interests of the area as a whole.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

The B.E.A.M.A. and the Universities.

The interesting letter of Mr. W. F. Dunton under the above heading in your issue of April 11th contained, in addition to some very useful information, certain unfortunate and somewhat controversial statements. I refer to Mr. Dunton's remarks concerning the survival of what he calls "obsolete ideas" in English universities.

Mr. Dunton is here attacking a system which has produced men of supreme eminence in mathematics and electrical theory, and upon whose researches the work of Steinmetz and many others has its foundation. I need only mention such names as Faraday, Clerk Maxwell, and Lord Kelvin, all of whom were professors in English universities, to arouse in the memory of anyone only slightly acquainted with the history of electrical theory an appreciation of work which has never since been equalled, much less superseded, and has earned for England a reputation second to none in the domain of mathematical physics. It must be remembered that such men as Maxwell, Kelvin, Stokes, and Rayleigh belonged to the Cambridge school, and received their training by methods established for many centuries; the logical inference is that these methods leave little to be desired from a didactic point of view.

The desirability of Steinmetz's methods is over-estimated by Mr. Dunton. I am unaware of any specific advantage attaching to a study of Steinmetz's writings, and have always considered it desirable that students should defer such study until they have sufficient training to avoid the misconceptions which the style peculiar to Steinmetz is so prone to introduce.

It is a significant fact that few references, except to his own papers, are given in Steinmetz's works. In the preface to one of his text-books he explains this by saying that a student is more concerned with the use of a proposition than its origin. While there is little doubt concerning the accuracy of this statement, the practice is undesirable; it tends to obscure the historical development of the subject, and to foster the disregard for tradition which is all too evident in Mr. Dunton's communication.

I may add that the researches of Mr. Dunton in engineering mathematics are well known to the majority of investigators. He has been responsible for much perfection of detail in this subject. I feel quite sure that his work has received the attention which is its due, and that his protests are exaggerated. The violence of his concluding remarks would appear to support this view. It seems necessary to point out that progress is obtainable only through logical discussion; it is impeded by controversy based on untried principles.

G. Windred.

Bedford, *April 14th*, 1930.

I heartily agree with Mr. W. F. Dunton in his statement that the B.E.A.M.A. overlooks the principal cause of our difficulty in meeting foreign competition, but I do not agree with his definition of the cause.

The real reason, as the B.E.A.M.A. is no doubt fully aware, is that the normal standard of pay for technical workers on design or research is so miserably low that the best brains are not attracted to, or are not retained on, the manufacturing side of electrical engineering.

So long as first-class honours graduates of the best English universities are offered salaries of the order of £3 per week for responsible design or development work, so long will those men continue to find other outlets for their energies and leave the field to the semi-qualified or rule-of-thumb worker, who, aware of his lack of ability, is content to accept a salary which a really good man would not.

Not only do most large British manufacturing firms offer beggarly salaries to engineering graduates after serving a two or three years' apprenticeship, but they also resent any attempt by a worker to improve his position by a change to another firm; in fact, there is in existence and operation a working arrangement among some employers to prevent the raising of standards by this means; the mere statement that a company "wishes to retain the services" of an employé causes the cessation of all negotiations for employment by another firm in the group.

A man is therefore forced either to accept low pay (which he only does if he is a comparative "dud," or if he is so devoted to the job that he supplements his income by other work, *e.g.*, teaching), or to move out of the manufacturing side of the industry into consulting or the supply industry, where his originality and analytical abilities stimulated by his training have but little scope, so that he has to desert work which is congenial for that which is not.

To cite a single specific example: a man elected as F.R.S. this year found, after taking an electrical engineering course, that engineering had nothing to offer him; he therefore turned to mathematical physics in which he has established a European reputation in a very few years.

Cases less striking than this are of such frequent, and indeed normal, occurrence as to cause a definite lowering of the standard of brains in the manufacturing companies, too many of the men who are retained being of the "rule-of-thumb" type, well-qualified regularly-trained engineers being of comparatively rare occurrence.

Thus, I would submit, with due deference to Mr. F. W. Dunton, that it is not because our university men are badly trained, but because too few of them are employed, that we are outstripped by other countries in which a degree is the essential qualification in order to be allowed to practice.

Cantab.

April 16th, 1930.

I was not surprised to find that Mr. Penemore, although a B.Sc. as well as an A.M.I.E.E., had been misled by "established rules" that ought to have been disestablished long ago. But the fifth paragraph of my previous letter should have convinced him that $f(x)$ may be a maximum or a minimum where $f'(x)$ and $f''(x)$ are both zero, and that the established teaching on this matter is therefore incorrect. Cases in which that teaching would mislead us are provided by every function whose graph crosses the x-axis with zero slope. I mentioned x^3 as the simplest example of such a function; which means that $2-\frac{1}{4}x^4$ is one of a family of functions having maximum values in defiance of the usual teaching.

A misprint occurred in my sixth paragraph, the index having been omitted from the function $x^2+2\cos x$, but, of course, that did not invalidate the proof that had been given in the fifth paragraph. I can only assume that the fifth paragraph had been overlooked by Mr. Penemore, and I hope that the matter is now quite clear to him.

W. F. Dunton.

Manchester, *April 17th*, 1930.

Synchronised Time.

Could you or your readers advise me whether a list exists of supply authorities in this country who are in a position to supply synchronised time to their consumers. This system is widely employed in the United States, where standard frequency clocks in the power stations are used to control the mains frequencies, and the consumer can plug in a suitable clock on any of his lighting sockets.

Synchronised.

April 16th, 1930.

Measurement of High Temperatures.

Under the above heading in your issue of April 18th thermo-couples of various metals are mentioned, but your correspondent seems to have overlooked a combination of metals which has become very common. A thermo-couple made of nickel-chrome matched against nickel treated with aluminium has many advantages over the platinum-platinum rhodium type, chiefly owing to the difference in price of the materials. These nickel-chrome couples are satisfactory for temperatures up to 1,000 deg. C., and the life at this temperature is quite considerable. It will be seen, therefore, that these thermo-couples bridge the gap between 750 deg. C., for which temperature iron-constantan couples may be used, and temperatures over 1,000 deg. C., for which platinum-platinum rhodium couples must be used.

For temperatures above 1,200 deg. C. pyrometers of the radiation or optical type are often more suitable.

We notice that Mr. Barham mentions the use of steel sheaths for temperatures up to 1,000 deg. C., whereas we consider this type of sheath should only be used for lower temperatures than 800 deg. C. Nickel-chrome sheaths are now almost invariably used for temperatures between 800 deg. C. and 1,050 deg. C., above which, as your correspondent states, fireclay sheaths are used.

Wild-Barfield Electric Furnaces, Ltd.,
J. E. Oram.

London, N.7, *April 17th*, 1930.

Electricity Supply Transformer Systems.

My attention has been called to the review of the above book in the March 21st issue of the Electrical Review. I note that the temperature limits, as advocated by Mr. Taylor, are criticised on the ground that they are lower than that recommended by the Transformer Sub-Committee of the A.I.E.E. As chairman of the Transformer Sub-Committee I would like to point out that it did

not recommend for continuous operation a temperature of 90 deg. C. for the oil. This paragraph was taken from the present A.I.E.E. Standards, which have been in use for many years.

It can readily be seen from the temperature limits recommended for continuous operation by temperature indicators that it would not be possible to reach an oil temperature of 90 deg. C. The tendency in America is not to increase transformer temperatures but rather to set up a temperature differential of at least 10 deg. between continuous operation and short time operation. I am enclosing a copy of my paper on "Loading Transformers by Temperature," which I think will explain fairly well the attitude in America on transformer temperatures under service conditions.

V. M. Montsinger,

Chairman, A.I.E.E. Transformer Sub-Committee.

Pittsfield, Mass., *April 11th*, 1930.

Mr. H. Quigley's Articles.

I find that quotation has been made from articles I have written over my own signature as if they were official pronouncements of the British Electrical and Allied Manufacturers' Association. It should be noted that such articles are based wholly on my own observations and deductions and represent, as a consequence, my own views. Any attempt to construe them into official statements of any association is strongly deprecated by the writer.

Hugh Quigley.

Esher, Surrey, *April 22nd*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

5,738. "Apparatus for locating hidden or invisible pipes or cables or like objects capable of conveying an electric current." G. Shepherd. November 23rd, 1928. (327,093.)

13,299. "Armature windings of dynamo-electric machines." English Electric Co., Ltd., and G. Schroeder. May 5th, 1928. (326,891.)

27,594. "Porous substances used as battery separators, diaphragms, and the like." Dr. M. Wilderman. September 25th, 1928. (327,131.)

27,585. "Wireless signalling systems." J. Robinson. September 26th, 1928. (327,112.)

30,206. "Method and means for controlling the potential of double-wound electric generators." Eclipse Machine Co. October 28th, 1927. (299,456.)

30,308. "Electric relays." A. Battaglia-Guerrieri October 19th, 1928. (327,100.)

34,554. "Loud-speakers." F. Graetz. November 23rd, 1928. (327,147.)

34,790. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. November 26th, 1928. (327,114.)

34,850. "Regulating systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. November 26th, 1927. (301,333.)

34,929. "Electric induction smelting furnaces." J. Harden. December 14th, 1927. (302,308.)

34,971. "Electric motor control system." Waygood-Otis, Ltd. December 3rd, 1927. (301,731.)

35,070. "Thermally-operated electric switches or relays." British Thomson-Houston Co., Ltd. November 29th, 1927. (301,425.)

36,662. "Electrical make-and-break contact for electric clocks and watches." J. Walker and J. V. Walker. December 31st, 1928. (327,169.)

37,896. "Process and apparatus for the production of X-rays." H. Plauson. December 22nd, 1928. (327,151.)

37,898. "Cathode-ray tubes." H. Plauson. December 22nd, 1928. (327,152.)

38,079. "Electric dry batteries." W. Saufmann and Diamco Akt. Ges. für Glühlicht. December 24th, 1928. (327,140.)

38,193. "Fluid pressure-operated electric switch." Marlo Refrigerating Co., Ltd., and F. C. Malin. December 27th, 1928. (327,173.)

38,540. "Junction box systems for electric power cable installations." L. B. Woodworth and Central Mining and Investment Corporation, Ltd. June 22nd, 1928. (314,046.)

38,587. "Signalling conductors." Electrical Research Products, Inc. June 29th, 1928. (314,510.)

38,588. "Telegraph systems." Electrical Research Products, Inc. March 9th, 1928. (307,488.)

1929.

256. "Electric through-flow heaters with automatic storage for liquids." O. Greatzer. January 21st, 1928. (304,590.)

977. "Sound transmission and reproduction by electrical means." A. E. C. Snell and F. S. Clifford. January 10th, 1929. (327,210.)

1,683. "Transformer systems for wireless-telephony and like purposes." Soc. des Etablissements Ducretet. January 17th, 1928. (304,242.)

2,471. "Insulation of electric conductors." Siemens Bros. & Co., Ltd. (P. E. Cheeseman). January 24th, 1929. (327,223.)

2,501. "Art of television." R. W. Strange. January 25th, 1928. (304,730.)

3,179. "Submarine cables." Siemens-Schuckertwerke Akt. Ges. February 18th, 1928. (306,393.)

3,732. "Transformers." J. Feldman. December 20th, 1928. (327,230.)

4,025. "Polarised relay." Tyer & Co., Ltd., and J. W. Punter. February 6th, 1929. (327,233.)

4,416. "Electric wire attachments." E. J. Francois. February 19th, 1929. (327,236.)

5,249. "Electric heating elements." Reliance Manufacturing Co. (Broughton), Ltd., and F. Foy. February 16th, 1929. (327,241.)

5,813. "Secret signalling methods." Standard Telephones and Cables, Ltd. February 21st, 1928. (306,494.)

6,015. "Electric switches controlled by clockwork mechanism." J. Kohnstam. February 23rd, 1929. (327,246.)

6,151. "Control of lifts operated by polyphase electromotors." Smith, Major & Stevens, Ltd., and P. H. Stevens. February 25th, 1929. (327,248.)

6,185. "Electric motors." J. Zetsche, N. Petersen, and J. Sinclair-Ross. February 25th, 1929. (327,249.)

6,357. "Electrical fuses or cut-outs." R. A. Smith and H. G. Baggs. February 27th, 1929. (327,252.)

6,749. "Electromagnetic clutches." F. Schuchhardt Berliner Fernsprech-und Telegraphenwerke Akt. Ges. December 28th, 1928. (327,257.)

6,969. "Means for transmitting wireless signals at a constant frequency." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 4th, 1929. (327,259.)

7,512. "Cathodes for electron-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 25th, 1928. (319,652.)

8,356. "Fastenings for electric installation fittings." Siemens-Schuckertwerke Akt. Ges. November 23rd, 1928. (327,269.)

8,513. "Adjusting and indicating devices for radio instruments having rotary parts." A. Preen. March 15th, 1929. (327,270.)

11,367. "Sound-producing devices." British Thomson-Houston Co., Ltd. April 12th, 1928. (309,555.)

11,368. "Tanks having external cooling elements, applicable to oil tanks for electrical transformers." E. L. Pease, Premier Radiator & Engineering Co., Ltd. April 12th, 1929. (327,295.)

11,546. "Electric lamp stands." P. Webber. April 15th, 1929. (327,296.)

11,795. "Loud-speakers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 27th, 1928. (310,526.)

11,816. "Electric motor-control apparatus." G. Somajni. April 20th, 1928. (Addition to 305,135.) (310,039.)

12,246. "Terminal mounts for use in radio sets." H. T. Logan. April 19th, 1929. (327,307.)

12,811. "Television apparatus." R. Bruni. April 25th, 1928. (310,424.)

13,709. "Electric motors without casings for building into other machines or apparatus." Siemens-Schuckertwerke Akt. Ges. May 15th, 1928. (311,732.)

15,377. "Electric motor control systems." British Thomson-Houston Co., Ltd. May 16th, 1928. (311,781.)

15,783. "Apparatus for use in photography by X-rays." Dr. A. Rona. June 12th, 1928. (313,490.)

17,573. "Tuning coils for wireless receivers." T. M. W. Jensen. June 7th, 1929. (327,338.)

18,626. "Picture and the like telegraph systems." Marconi's Wireless Telegraph Co., Ltd. June 16th, 1928. (313,857.)

19,699. "Electric motors." Siemens-Schuckertwerke Akt. Ges. July 13th, 1928. (315,404.)

20,772. "Electric inductances and transformers." H. A. P. Littledale. July 6th, 1929. (327,356.)

21,091. "Electric furnaces of the inductor type." E. F. Northrup. August 2nd, 1928. (316,662.)

21,360. "Apparatus for X-ray investigations." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. July 21st, 1928. (Addition to 301,377.) (315,869.)

21,382. "Electrical resistance welding with rolling electrodes." E. A. Rosengrens Kassaskaps-Fabriks Aktiebolag. March 12th, 1929. (327,361.)

23,551. "Electric insulators for high pressures." International General Electric Co., Inc. July 31st, 1928. (316,588.)

28,058. "Methods of and means for balancing rotors." British Thomson-Houston Co., Ltd. September 17th, 1928. (319,211.)

1930.

3,808. "Telephone systems." Associated Telephone and Telegraph Co. March 17th, 1928. (Divided application on 307,913.) (327,375.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 16th :—

Dragon. No. 507,825. Class 8. Dry flash-lamp batteries.—J. Weinbaum, trading as the Stormlight Incandescent and Electrical Co., 162, Mile End Road, E.1.

Phonoxion. No. 510,439. Class 8. Electrical sound reproducing apparatus. —Mildred E. Cox, trading as Connor & Co., 23, Charing Cross, S.W.1.

Rox (lettering and design). No. 508,400. Class 13. Electric lighting, heating, and cooking fittings, incandescent electric lamps (ordinary), &c.—Weiss, Biheller & Brooks, Ltd., 71, Chiswell Street, E.C.1.

Soft Solders and Soldered Joints.

The British Non-Ferrous Metals Research Association has just issued under the above title Part I of Research Report No. 3 on "The Jointing of Metals," price 10s. The report deals with an investigation which was started in 1922 by Mr. S. J. Nightingale and included studies of hard soldering or brazing, silver soldering, and some aspects of autogenous fusion as applied to the non-ferrous metals. The bulk of the experimental work fell naturally in the field of soft solders; partly because it presented an almost virgin field for experiment, but also because some of the principles involved, directly applicable to hard soldering, could, with much greater facility and accuracy, be determined in the cooler and more flexible medium of soft solder. Interim reports on brazing and brazing solders are in existence and will, subsequently, be collated and issued in conformity with the one in question. These deal more particularly with the effect of impurities in silver solder; hard solders of lower melting point than usual; the strength of brazed joints; the brazing of certain alloy steels; some of the rare earth metals and the more uncommon brasses and bronzes; fluxes for special purposes, &c. A fairly comprehensive study has also been made of the autogenous welding of copper. The experimental results which go to make material for the report are largely due to the ability and manipulative skill of Alexander Greig, assisted by G. A. Shires, M.Sc., and the late Harold Heape, M.Sc., who was responsible for the section on the corrosion resistance of the solder alloys. The purpose of the report is to set out the results and conclusions arrived at in the course of the investigation in a form suitable to interested members. In this form, naturally, circulation is limited to those members who, as manufacturers or users, have to deal with solders on a large scale. It is thought, however, that a good deal of the matter would have a much wider appeal among practical men if presented in a popular form. Accordingly it has been decided to issue soon another edition in which the highly technical sections are eliminated and the more practical ones amplified.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALEXANDRIA (Dumbartonshire).—R.C. school (600 places); Executive Officer to the County Education Authority.

ANNBANK.—School, with electrical work, for Ayrshire E.C.; W. Reid, education offices, Ayr.

BIRKENHEAD.—Offices for the Halifax Building Society; M. W. & W. M. Shennan, architects, Hamilton Square.

BLACKLEY.—Additions to works, Clough Road; architects, Leech & Ratcliffe, 7, Cheapside, King Street, Manchester.

BO'NESS (N.B).—Housing scheme; burgh surveyor.

BRADFORD.—Modernising of St. Luke's Hospital (including two operating theatres); secretary.

CHEADLE.—School, Etchells (deposit £2 2s.); F. A. Browne, county architect, Newgate Street, Chester.

CHEAM (Surrey).—Houses (66), Quarry Park Road, Quarry Rise; A. Keen. Houses (38), Colbourn Way; W. T. Mills & Co.

CHESTER.—School, John Street, Ellesmere Port, for the E.C.; T. Warrington & Sons, contractors, King Street, Ellesmere Port.

CHURCH GRESLEY.—Primitive Methodist Church, Colton; trustees.

CONGLETON.—Houses (78) for the T.C.; Kearton & Jones, builders.

DARTFORD.—Houses (100), Heathlands estate; New Ideal Homesteads, Ltd. Extensions, hospital; Joint Hospital Board.

DERBY.—School, Nottingham Road (720 places), for the borough E.C.; director of education.

DEVIZES.—Additions to factory premises of C. Sloper and Sons; W. E. Chivers & Sons, Ltd., builders, Estcourt Street.

DEVON.—Schools at Torquay and Bishopstawton for Devon E.C.; county architect, Exeter.

DONCASTER.—Alterations, &c., Cantley Hall, for T. B. Darley; Garside & Pennington, architects, Ropergate, Pontefract (returnable deposit of £3 3s.).

DUMFRIES.—Public lavatories, St. Michael's Bridge, with electrical work, for the T.C.; J. Barker, burgh surveyor.

DUNSTABLE.—Police station, superintendent's residence, &c., for Beds. C.C.; F. W. Smart, county surveyor, Bedford (returnable deposit of £1 1s.).

ECCLESHALL.—Pavilions, operating theatre block, &c., Standon Hill Hospital, for Staffs. E.C.; K. L. Murray, county architect, Stafford (returnable deposit of £2 2s.).

EDINBURGH.—Additions and alterations to Corstorphine public school (£10,500); Master of Works, Education Authority. Child welfare clinic at Portobello, for Corporation; city architect.

ESSEX.—Intermediate school, Grays, for the Essex E.C.; J. Stuart, county architect, Chelmsford (returnable deposit of £2 2s.).

ETON.—Houses (32), Coppermill Road, Horton; J. C. Buckingham.

FAVERSHAM.—Housing scheme (70) for the T.C.; S. P. Andrews, borough surveyor (returnable deposit of £3 3s.).

GLASGOW.—Houses (932) for Corporation, at Thornliebank; city architect.

GLOUCESTER.—Training college hostel (£38,000) for Glos. E.C.; John Simmonds, builder.

GLOUCESTERSHIRE.—Schools, Cirencester (£32,000), Bitton (£22,400), Dursley (£25,600), Filton (£9,600), Drybrook (£16,000), Mangotsfield (£32,000), Northleach (£8,000), Tewkesbury (£22,400), and Wotton-under-Edge (£25,600), for the E.C.; director of education, Gloucester.

GREENOCK.—School, Ladyburn, for Renfrewshire Education Authority (£50,000); Master of Works, Education Authority, Paisley.

HAMPSHIRE.—Schools, Totton, Eastleigh, Chilworth, Basingstoke, Christchurch, and West End and Hedge; Hampshire E.C.

HUDDERSFIELD.—New school and extensions (£50,900); director of education. Business premises and warehouse, with lift and heating and lighting work; Norman Culley, architect.

IRISH FREE STATE (Thurles, Co. Tipperary).—Extensions, Presentation Convent; R. M. Butler, architect, 82, Merrion Square South, Dublin.

(Cahir, Co. Tipperary).—Technical school at Convent of Mercy; Rev. Superioress.

HARTLEPOOL.—Waterworks, Dalton Piercy (£60,000); Hartlepool Gas & Water Co., Ltd.

IRLAM.—Housing scheme (140); surveyor to U.D.C.

KENT.—Schools, Herne Bay, Sturry, and Sandwich, and enlargement of central school, Crayford, for the Kent E.C.; E. Salter Davies, director of education, Maidstone.

LEEDS.—Hotel, Queen's Road, Hyde Park; manager, Wharton's Hotel, Park Lane.

LIVERPOOL.—Extension of Walker Art Gallery; city architect.

LONDON (Bethnal Green, E.).—Tenements, Collingwood estate (£150,000); L.C.C. architect.

(Finsbury, N.).—Tenements, Margaret Street (£153,000); borough engineer.

(St. Pancras, N.W.).—Tenements (121), shops (8), Ossulton estate (£76,953); Rowley Bros., Ltd., Tottenham.

(Hendon, N.W.).—Houses (36), Oakmead Gardens and Northolme, Mill Hill; H. Boot & Sons. Houses (20), Copthall Gardens, Mill Hill; H. Merrylees.

(Lewisham, S.E.).—Kinema theatre, High Street, with electrical work, for the Prince of Wales Picture Playhouse; J. S. Beard & Clare, architects, 101-3, Baker Street, W.

(Balham, S.W.).—Maternity Home, Grove Road (£29,222); F. D. Hidden & Co., Ltd., Brentford.

(Wandsworth, S.W.).—Flats (72), Merton Road (£49,855); J. Billings & Co., Ltd., Westminster.

(Ealing, W.).—Flats (30), Hangar Hill, for Ardsley Estates Ltd., and ten shops and flats, Dorchester Road, for Reidco Estate, Ltd.; T. P. Bennett & Son, architects, 41, Bedford Row, W.C.1. Houses (24), Whitton Drive; P. H. Edwards, Ltd., architects, 287, Golders Green Road, N.W.11. Motor showroom and garage, Uxbridge Road, for Brentford Motor and Commercial Car Co., Ltd.; Hall-Jones & Dewhirst, architects.

LOWESTOFT.—Houses (100); borough engineer.

LYMINGTON.—Housing scheme (36) for the R.D.C.; R. O. L. Lovell, surveyor (returnable deposit of £2 2s.).

MANSFIELD.—School (880 places), Ravensdale housing estate, for the Borough E.C.; director of education.

MARKET HARBOROUGH.—Houses (500), off Northampton Road; borough engineer.

MIDDLESBROUGH.—Chemical works, Port Clarence; Imperial Chemical Industries, Ltd., Millbank, London.

MIDLOTHIAN.—School, East Calder (£28,800); Master of Works, Midlothian Education Authority, Edinburgh.

NANTWICH.—Sewage disposal works; surveyor to U.D.C.

NELSON.—Stores, Scotland Road, for F. W. Woolworth and Co., Ltd.; W. Priddle, architect, Victory House, Kingsway, London, W.C.2.

OSWALDTWISTLE.—Alterations and improvements to sewage disposal works (£15,000); surveyor to U.D.C.

PENZANCE.—Houses (58) for T.C. (£26,905); J. H. Lobb, Mevagissey, contractors.

ROCHDALE.—Model dairy for the Rochdale Provident Co-operative Society, Ltd.; Architect's Department, C.W.S., Ltd., 113, Corporation Street, Manchester.

ROTHERHAM.—School (400 places), Herringthorpe, for the Borough E.C.; director of education.

SLEAFORD.—Houses (50) for the U.D.C.; Mr. Sandall, builder, Swineshead.

SMETHWICK.—Bridge reconstruction (£74,000); borough engineer.

STOKE-ON-TRENT.—Houses (112), Lodge estate; Sutton Trustees.

SWANSEA.—Houses (76), Penlan estate, Treboeth; Ll. L. Thomas. Houses (66), Townhill estate (£25,800), for Corporation; Thomas Jenkins. Extensions to girls' school (£47,000); borough architect. Extensions, Rheanfa Hospital (£18,000); medical officer.

TADCASTER.—Sewage disposal works, Church Fenton; surveyor to R.D.C., Council offices, Kirkgate.

TAIN.—Alterations, including electric lighting installation, Queen Street Church of Scotland; the minister.

WALSALL.—Extensions, municipal offices (£6,500); borough engineer.

WARWICKSHIRE.—New schools, Wyken and Ansley, and extensions, Arley, Atherstone, and Halford schools; Warwickshire E.C.

WIGAN.—School, Pemberton (£25,807), with lighting and heating work, for the Borough E.C.; borough engineer.

WIMBORNE.—Housing scheme (56) for the R.D.C.; W. G. Hall, 8, Church Street (returnable deposit of £3 3s.).

WORCESTERSHIRE.—Schools, Evesham, Pershore, and Catshill; county architect.